Systematic and cladistic studies of *Myrtella* F. Muell. and *Lithomyrtus* F. Muell. (Myrtaceae)

Neil Snow and Gordon P. Guymer

Summary

Snow, N. & Guymer, G.P. (1999). Systematic and cladistic studies of *Myrtella* F. Muell. and *Lithomyrtus* F. Muell. (Myrtaceae). *Austrobaileya* 5(2): 173-207. A systematic revision of species formerly placed in *Myrtella* F.Muell. (Myrtaceae) is presented. Species primarily from New Guinea remain in *Myrtella* sensu stricto (*M. beccarii*, *M. bennigseniana*) whereas all species from Australia are transferred to the genus *Lithomyrtus* F.Muell. *Lithomyrtus* includes seven new species viz *L. densifolia* N.Snow & Guymer, *L. dunlopii* N.Snow & Guymer, *L. grandifolia* N.Snow & Guymer, *L. hypoleuca* N.Snow & Guymer, *L. kakaduensis* N.Snow & Guymer, *L. linariifolia* N.Snow & Guymer and *L. repens* N.Snow & Guymer. Four new combinations viz *L. cordata* (A.J. Scott) N.Snow & Guymer, *L. microphylla* (Benth.) N.Snow & Guymer, *L. obtusa* (Endl.) N.Snow & Guymer and *L. retusa* (Endl.) N.Snow & Guymer are made for other species belonging to *Lithomyrtus*. *Myrtella phebalioides* (W. Fitzg.) A.J.Scott is reduced to synonymy under *L. retusa*, and *M. rostrata* Lauterb. is transferred to *Uromyrtus* as *U. rostrata* (Lauterb.) N.Snow & Guymer. Character data and preliminary cladistic studies strongly support the generic separation of *Lithomyrtus* from *Myrtella*, but all clades within *Lithomyrtus* in the strict consensus tree are highly unstable. Iterative studies with additional outgroups are needed to more confidently infer generic and specific relationships in *Lithomyrtus*, *Myrtella* and related genera.

Keywords: *Myrtella*, *Lithomyrtus*, *Fenzlia*, *Uromyrtus*, Myrtaceae, Myrtoideae, systematics, cladistics, Australia, New Guinea.

Gordon P. Guymer, Queensland Herbarium, Brisbane Botanic Gardens Mt Coot-tha, Mt Coot-tha Road, Toowong, Queensland 4066, Australia; e-mail: Gordon.Guymer@env.qld.gov.au

Neil Snow, Department of Biological Sciences, University of Northern Colorado, Greeley, 80639, USA; e-mail: nsnow@bentley.unco.edu

Introduction

The family Myrtaceae Juss. is particularly rich in South America and Australasia (Cronquist 1981; Johnson & Briggs 1985; Wilson 1996; Mabberley 1997), with new taxa being described yearly (Sobral 1994; Bean & Brooker 1995; Lyne & Crisp 1996). Although some genera have been revised recently (e.g., Landrum 1981, 1988; Ladiges & Humphries 1983; Thiele & Ladiges 1988; Grifo 1992; Hill & Johnson 1995; Toelken 1996; Chappill & Ladiges 1996; Bean 1997a, b), many remain poorly studied. Other biological aspects of Myrtaceae have recently been investigated from various perspectives (Beardsell et al. 1993; Krauss 1994; Costa et al. 1995; Nic Lughadha & Proença 1996; Byrne et al. 1996; Gadek et al. 1996; Landrum & Bonilla 1996; Haron & Moore 1996; Orlovich et al. 1996; Shapcott & Playford 1996; Sale et al. 1996).

Taxa previously placed in *Myrtella* F.Muell. sensu lato were reviewed most recently by Scott (1978). For some time, Australian botanists have been aware of undescribed species in the Northern Territory, particularly in the sandstone escarpment regions of Kakadu National Park and neighbouring areas that relate to this genus. In this paper, we cladistically test the hypothesised monophyly of the predominantly New Guinean taxa (included in *Myrtella* s.s. herein) and the exclusively Australian taxa (included in *Lithomyrtus* F.Muell. herein), describe seven new species in *Lithomyrtus*, provide the first comprehensive revisions of both genera and transfer *Myrtella rostrata* Lauterb. to *Uromyrtus* Burret.

Taxonomic history

Species herein assigned to *Myrtella* and *Lithomyrtus* traditionally have been treated as congeneric under *Myrtella* (Scott 1978). This

---

Accepted for publication 8 October 1998

account is the first to accept *Lithomyrtus* for Australian species traditionally assigned to *Myrtella*. As detailed below, this generic segregation is strongly supported by cladistic studies.

The name *Myrtella* has been associated with *Fenzlia* which Endlicher (1834) published with the detailed description and illustration of two Australian species (*F. obtusa* and *F. retusa*). As correctly noted by Scott (1978), *Fenzlia* Endl. is an illegitimate later homonym of *Fenzlia* Benth. (Polemoniaceae). Mueller (1877) published *Myrtella* for two new species from New Guinea based primarily on their "nearly valvular preflorescence of the calyx", although he was unable to suggest tribal affinities of this genus due to the absence of fruits. One of Mueller's two initially described species, *Myrtella hirsutula* F.Muell. was recently transferred to *Kania* Schlechter by Scott (1990).

Bentham (1866) described *Fenzlia obtusa* var. *microphylla* as new based on its leaf size, and placed *Fenzlia* in his tribe Myrteae which he characterized as having an ovary divided into two or more cells (rarely 1-celled) with parietal placentation and the fruit having a berry or drupe (but see discussion of characters, Appendix 1). Bentham and Hooker (1867) largely followed the more detailed account of Bentham (1866). Niedenzu (1893) was the first to correctly identify the testa layer as the hard portion of the fruit, which earlier had been designated incorrectly as endocarp.

Burret (1941) merged *Myrtella* with *Fenzlia*, and partitioned the species then known into sections *M.* sect. *Myrtella* F.Muell. and *M.* sect. *Eufenzlia* Burret. He contradicted himself by saying initially the genera always look very different ("... sehen habituell recht verschieden aus") but later indicated he was unable to find any substantial differences between them ("Wesentliche Unterschiede zwischen beiden Gattungen finde ich night"). The latter statement is also at odds with the characters he used to recognise the sections.

Lithomyrtus was described by Mueller (1857: 228) as a "new genus, *Lithomyrtus*, MSS.," which he distinguished from *Psidium* L. by its "dry berry and a circinate embryo". Although no particular species was included in it at that time, Mueller's diagnosis of *Lithomyrtus* constitutes valid publication of the name (see ICBN Articles 32.1 and 41.2). Later, Mueller (1858: 156) again made reference to *Lithomyrtus*, but although labels on some of his specimens bear the name *L. hypoleuca* (DBL and K, photos at BRI), this combination was never published (Muir 1978). Later still, Mueller (1882) apparently abandoned *Lithomyrtus*, since he excluded it from the synonymy for native genera of Australian plants. It is not clear to which genus Mueller then intended to assign specimens he annotated as *Lithomyrtus hypoleuca* (see above). He may have considered *L. hypoleuca* conspecific with *L. obtusa*.

In the most recent synopsis of the genus *Myrtella* Scott (1978) recognized sections *M.* sect. *Myrtella* (4 spp.) and *M.* sect. *Fenzlia* (5 spp.), and described as new the Australian species *M. cordata*. Briggs & Johnson (1979) and Johnson & Briggs (1985), however, maintained *Myrtella* as generically distinct from *Lithomyrtus* (as *Fenzlia*).

Materials and methods

Taxonomic descriptions: Taxon boundaries (Snow 1997) and character data for *Lithomyrtus* were determined from herbarium specimens and fresh and preserved material collected in the field; for *Myrtella* only herbarium specimens were used. The list of characters (Appendix 1) and natural language descriptions were generated using the DELTA program of Dallwitz et al. (1993). Embryos were absent in all fruits of *Lithomyrtus linariifolia* and *L. hypoleuca* examined. Terminology for tissue layers of fruits and seeds follows Esau (1960). Conservations status evaluations are made according to IUCN categories (Species Survival Commission 1994).

Cladistic analysis: Phylogenetic relationships of *Myrtella* and *Lithomyrtus* were inferred using PAUP Vers. 3.1.1 (Swofford 1993) with the branch and bound algorithm (Hendy & Penny, 1982) with the following options –

keep minimal trees only, collapse zero length branches, additional sequence furthest, and MULPARS. All characters were unordered and unweighted (Appendix 2; Table 1). A test for phylogenetic signal was assessed using the g1 statistic with 10,000 random trees (Huelsenbeck 1991). A successive weighting procedure based on the rescaled consistency index (Naylor & Kraus 1995) was implemented following the unweighted analysis. Candidate outgroups were not obvious since many genera of Australasian Myrtoideae have been poorly studied and generic relationships among them untested. We thus designated *Myrtella* as the outgroup and rooted the trees to make *Lithomyrtus* a sister clade to *Myrtella*. The stability of clades in the strict consensus tree was evaluated using minimal character support values (Davis 1993).

Results and discussion of cladistic analysis

Unweighted analysis: The g1 value of -2.82 indicates considerable left-hand skewness suggesting greater phylogenetic signal than expected at random (Huelsenbeck 1991). The unweighted analysis resulted in four most-parsimonious trees (MPTs) of 70 steps (after rooting: ci = 0.857; ri = 0.744, rc = 0.637). The one fully-resolved MPT and the strict consensus tree are illustrated in Figures 1& 2.

In all MPT's, the two species of *Myrtella* s.s. formed a clade basal to *Lithomyrtus* giving cladistic support to the hypothesis that these genera are distinct (Fig. 1). Thirteen uncontested synapomorphies support the distinctness of *Lithomyrtus* from *Myrtella* (2, 3, 8, 10, 13, 14, 16, 19, 22–26). Although some of these characters may break down in Myrtaceae when viewed collectively this analysis strongly supports segregation of *Lithomyrtus* from *Myrtella*.

The exceptionally strong support for the separation of *Myrtella* from *Lithomyrtus* contrasts markedly with the weak support for separation of clades within *Lithomyrtus*. Since each clade within *Lithomyrtus* in the strict consensus tree can be collapsed by the removal of a single character (Davis 1993), little weight should be accorded to those clades until congruency testing with additional characters suggests better support (Patterson 1982).

Successively weighted analysis: Successive weighting based on the rescaled consistency index converged on two MPT's after only one iteration. The strict consensus tree based on successive weighting (Fig. 3) had only two additional nodes resolved relative to the unweighted strict tree, so this procedure was of minimal help in inferring uncontested patterns of descent. However, the tree very closely resembled the one fully-resolved tree from the unweighted analysis.

The choice of root can strongly influence character polarity and the recognition of monophyletic groups (e.g., Scotland 1992). Since generic relationships in Myrtaceae remain poorly known and most untested cladistically, further analyses with additional outgroup genera will be necessary before reliable inferences can be made regarding relationships between *Lithomyrtus*, *Myrtella* and related genera. In particular, the monotypic *Myrtastrum* Burret (New Caledonia) and *Neomyrtus* Burret (New Zealand), which resemble *Myrtella* in gross morphology, may be closely related and thus are candidate genera. However, given the geographic proximity of *Myrtella* (mostly New Guinea) and *Lithomyrtus* (exclusively Australian) and the fact that many myrtaceous genera (e.g., *Austromyrtus s.l.*, *Melaleuca*, *Asteromyrtus*, *Eucalyptus*) range across these areas, it was not unreasonable to use *Myrtella* to root a cladistic analysis of *Lithomyrtus* for a first approximation of species relationships.

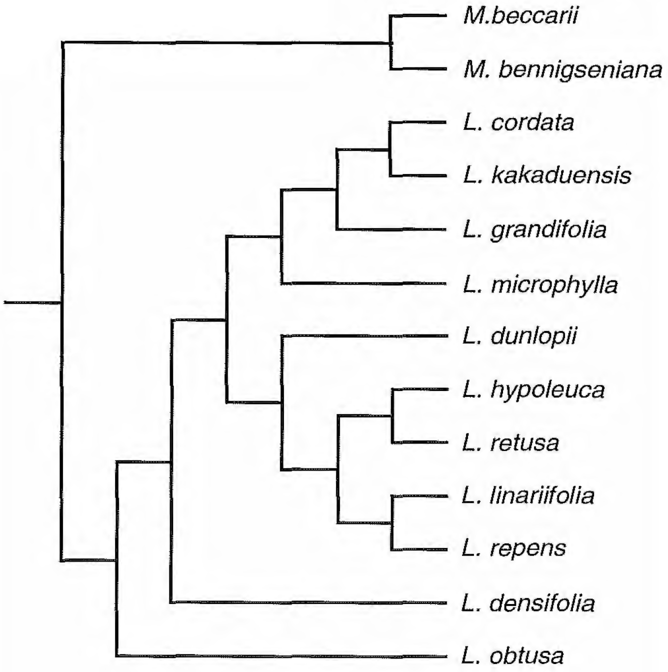

Figure 1. One of four most parsimonious trees resulting from branch and bound search using unweighted and unordered characters, with *Myrtella* designated as outgroup a priori.

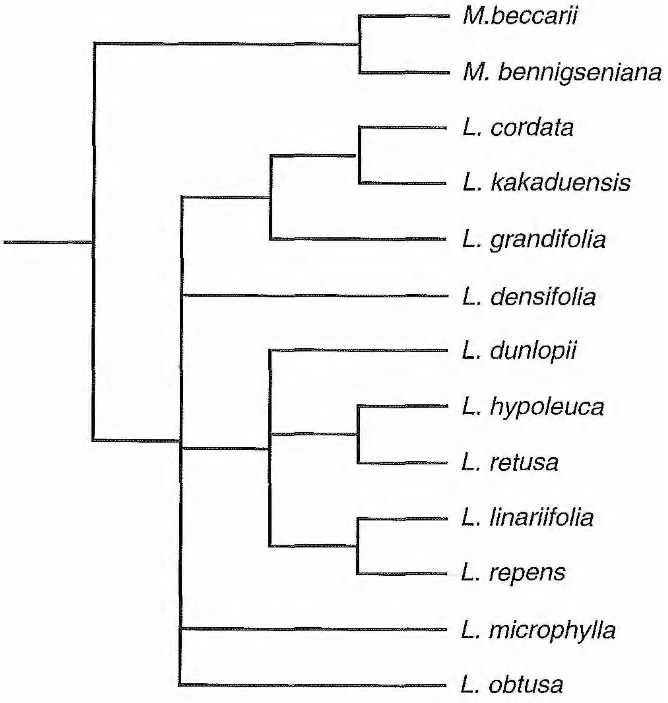

Figure 2. Strict consensus tree.

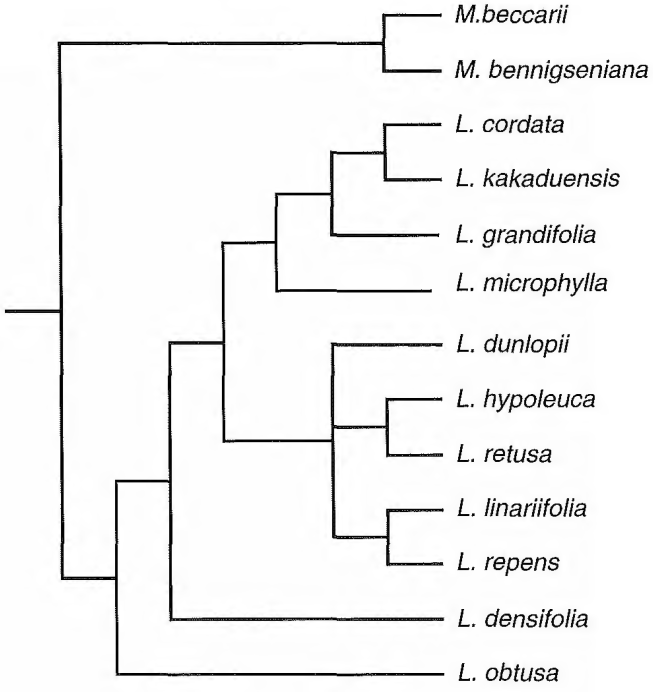

Figure 3. Strict consensus tree based on successive weighting with the rescaled consistency index.

Taxonomic treatment

Key to Genera

Branchlets distinctly 4-angled, edges of younger stems winged, the wing apices flaring outward; leaves mostly glabrous above and below (but often sericeous on lower portions of midvein); stipules very short, thick, dark red, scale-like, often fused laterally; apex of youngest leaves distinctly comose; bracteoles glabrous (or minutely hairy on edges), leaf-like and usually with a midvein, somewhat falcate and flexuous, usually persistent in fruit; sepals valvate in bud; stamens uni- or multiseriate; fruits globular, less than 5 mm long, glabrous, red to nearly black; staminal disk glabrous; style glabrous; ovary 2 or 3 (or 4)-locular; ovules 2–4 per locule; embryo relatively thick, slightly curved or crescent-shaped; embryo not spirally contorted, thickened towards tip; cotyledons straight, thick, very short. Indonesia (Irian Jaya), Papua New Guinea, Guam; reported also from Mariana and Caroline Islands . . . . **Myrtella**

Branchlets rounded, younger twigs rounded; leaves mostly somewhat hairy above, often villous to tomentose below; stipules consisting of two to several free ferrugineous setose hairs; apex of youngest leaves not distinctly comose; bracteoles hairy (or at least glabrescent), scale-like and lacking a midvein, straight or slightly curved, usually absent in fruit; sepals imbricate in bud; stamens multiseriate; fruits globular to cylindrical or fusiform, mostly greater than 5 mm long, glabrescent to densely tomentose, yellow- to olive-green or whitish by virtue of dense hairs; staminal disk hairy; style often sericeous, especially near base; ovary 1-locular; ovules (1–) 2 (or 3) per locule; embryo relatively thin; circinate; embryo sometimes spirally contorted, slightly thickened towards tip; cotyledons circinate, thin, relatively long. Tropical Australia . . . . **Lithomyrtus**

Myrtella F.Muell., Descr. Notes on Papuan Plants 1: 105 (1877). **Type:** *Myrtella beccarii* F.Muell. (lecto: fide Scott 1978).

Saffordiella Merrill, Philipp J. Sc. 9: 124 (1914). **Type:** *Saffordiella bennigseniana* (Volk.) Merrill.

Shrubs or small trees, 0.3–6.0 m tall. Bark smooth or stringy, brown or grey. Branchlets distinctly four-angled, the edges distinctly winged, glabrous or sparsely sericeous to villous near apex of internodal wings, oil glands visible and prominent, or lacking. Leaves decussate, opposite, evenly distributed or mostly concentrated near branch tips, coriaceous. Stipules consisting of 2–several short, thick, dark red, often laterally fused scale-like structures. Petioles 0.5–1.0 mm long, not channelled, eglandular. Leaf blades narrowly elliptic to narrowly ovate, margins usually slightly revolute, bases truncate, not clasping the stem, apex obtuse, upper surface mostly glabrous but sericeous on lower portion of midvein (young leaves apically comose), adaxial midvein impressed or not, lower surface glabrous or sericeous on lower portion of midvein, glands of lower surface visible and about the same size, marginal veins of lower surface invisible or indistinct. Inflorescence a solitary axillary flower. Peduncles rigid, glabrous. Bracteoles foliaceous, midrib usually present, irregularly flexuous, the tips (in flower) exceeding base of sepal lobes, glabrous, mostly persistent in fruit. Hypanthium obconic, glabrous. Sepals 5, fused below. Sepal lobes valvate in bud, apex acute, glabrous to sparsely short tomentose along edges, persistent in fruit, more or less ascending and mostly held above fruit. Petals 5, white to pink, elliptic to ovate, upper surface glabrous, lower surface glabrous to minutely tomentose on edges. Stamens 15–50, uni- or multiseriate, included, folded centrewards in bud. Staminal disk glabrous. Anthers subglobose, dorsifixed, versatile, less than $^1/_4$ length of filaments, dehiscence by longitudinal slits, connective glandular or eglandular. Ovary 2 or 3 (or 4)-locular, ovules 2–4 per locule, placentation parietal.Style 1, flexuous, or mostly straight, glabrous. Stigma 1, terete or scarcely (if at all) capitate. Fruit indehiscent, a hard berry with bony, more or less fused seeds, subglobose to globose, the base somewhat tapered, glabrous, red or dark blue to brown or nearly black (when dried). Seed coat hard, bony. Adjacent seeds slightly fused, their boundaries in longitudinal section generally distinct and perpendicular to long axis of fruit. Embryo slightly curved to crescent-shaped. Radicle relatively short, relatively thin, swollen near tip, the tip not spirally contorted (held at same horizontal plane as embryo). Cotyledons straight, relatively short; shorter than hypocotyl, relatively thick, not folded back towards hypocotyl.

Papua New Guinea, Irian Jaya, Guam; reported but not verified from Caroline Islands and Mariana Islands (Diels 1921).

Key to species of *Myrtella*

Leaves greater than 9 mm long; internodes of branchlets mostly longer than 0.4 cm; wings of young twigs hairy only near apex; stamens multiseriate . . . . 1. **M. beccarii**

Leaves less than 6 mm long; internodes of branchlets mostly shorter than 0.3 cm; wings of young twigs hairy throughout; stamens uniseriate . . . . 2. **M. bennigseniana**

1. **Myrtella beccarii** F.Muell., Descriptive Notes on Papuan Plants 106 (1877). **Type:** Indonesia. Irian Jaya. Baia de Humboldt, XII/1875, *Beccarii* 37777 (lecto: here designated FI).

Shrubs or small trees, 0.5–5 m tall. Bark smooth or stringy, brown. Branchlets glabrous to sparsely sericeous near apex of internodal wings, oil glands prominent. Leaves more or less evenly distributed. Petioles 0.5–1 mm long, rounded, eglandular. Leaf blades narrowly elliptic to elliptic, 7–11(–13) mm long, 2–3.5(–5) mm wide, base truncate, apex obtuse, margins revolute, upper surface glabrous except for sericeous lower portion of midvein and young leaves, adaxial midvein flush above, lower surface glabrous or sericeous on lower portion of midvein, marginal veins of lower surface absent or indistinct. Peduncles 3–4 mm long in flower. Bracteoles 3–3.5 mm long, 0.6–0.8 mm wide, glabrous. Sepal lobes 2.5–3 mm long, sparsely short-tomentose along edges. Petals white, ovate, 4 mm long; the lower surface minutely tomentose on edges. Stamens uniseriate or biseriate, c. 2.5 mm long; anther connectives eglandular. Style 2.5–4 mm long, flexuous or mostly straight. Fruit subglobose, sometimes abruptly tapered to base, 2.5–4.5 mm long, 2.5–3.5 mm wide, green, turning red to dark brown or nearly black at maturity. Fig. 4 A–H.

Specimens examined: Papua New Guinea. Morobe District: Lae Subdistrict. Lasagna Island, 7°25'S, 147°15'E, Nov 1969, *Streimann* NGF44305 (BRI, L); Buso Village, 7°25'S, 147°10'E, Nov 1969, *Streimann* NGF44151 (BRI, L); Buso River, *Foreman* LAE52292 (L); Buso River, SE of Lae on the coast, opposite Lasagna Island, 7°25'S, 147°10'E, Nov 1973, *Jacobs* 9650 (L); Buso River in lower land beside the river, Jun 1980, *Rau* 603 (L); 8 km S of Salamaua, Sep 1973, *Paijmans* 1564 (L); Buso, 7°25'S, 147°10'E, Nov 1979, *Henty* LAE72469 (CANB, L, QRS); Koneipa Village, Kipu, 7°50'S, 147°10'E, Jan 1966, *Streimann & Kairo* NGF26129 (BRI, L); Buso, S of Lal, Jun 1978, *Bellamy* B6 (L). Morobe Subdistrict: Paiawa Valley, along lower reaches of Paiawa River, 7°35'S, 147°15'E, May 1970, *Johns* NGF47319 (BRI); Buso (Morobe), S of Lae, Jun 1970, *Bellamy* s.n. (CANB, L); Creek at end of logging road near Paiawa River, SPT, 7°30', 147°15'E, Oct 1965, *Gillison* NGF25026 (CANB, L); Payawa Village, 7°35'S, 147°10'E, Jun 1981, *Katik* LAE74928 (L). Northern District: Ca 2 miles S of Toma, Bariji-Managalese area, Sep 1964, *Pullen* 5919 (BRI, L). West New Britain District: Hoskins Subdistrict: NNE slope Mt Ulawon, 5°02'S, 15°22'E, Feb, 1971, *Stevens* LAE51251 (BRI, CANB, L). District Unknown: Korepa, 7°55'S, 147°05'E, *Kairo* 47 (CANB). **Indonesia.** Irian Jaya: District Hollandia: Cycloop Mts, along path to Neta, Jun 1938, *Mayer Dress* 138 (L); Cycloop Mts, foothills W of Koejaboe River and E of Hoebal River, *Royen* 4149 (L). District Radjah Ampati: Weigo Island, E bank of Majalibit Bay, Jan 1955, *van Royen* 5217 (CANB, L); Town of Sukarnapura, *Koatermanns & Soegong* 560 (L); Waigeo Island, Kabaré Bay, Jan 1955, *van Royen* 5361 (L).

***Distribution and habitat*:** Papua New Guinea, Indonesia (Irian Jaya); reported but not verified from Solomon Islands and Micronesia (Scott 1990). Growing in a wide range of habitats, predominantly in moist rocky and disturbed areas but also near beaches, in forests of *Weinmannia* or *Casuarina*, and in xerophytic vegetation on ultrabasic soils (*van Royen* 5361), at altitudes from near sea level to 2500 metres.

***Phenology*:** Flowering January to November; fruiting mostly April to November.

***Notes*:** The flowers of *M. beccarii* are white, and the stamens are reported to be pale green or cream coloured. The bright red fruit dries to a much darker red colour. Due to the wide elevational range, additional or cryptic taxa may exist within it as currently accepted.

***Conservation status*:** Herbarium labels often report the species as locally common or abundant.

***Local names*:** zagiebara (Middle Waria, *Streimann & Kairo* NGF26129 [BRI, L]).

2. **Myrtella bennigseniana** (Volk.) Diels in Engl. Bot. Jahrb. 56: 529 (1921); *Leptospermum bennigsenianum* Volk. in Engl. Bot. Jarhb. 31: 407 (1902); *Saffordiella bennigseniana* (Volk.) Merrill, Philipp. J. Sci. 9: 124 (1914); *Fenzlia bennigseniana* (Volk.) Burret, Notizb. Bot. Gart. Berlin 15: 500 (1941). **Type:** Caroline Islands, *Volkens* 277 (lecto: CAL, here designated) (type material at B destroyed, fide Hiepko 1987).

Shrubs or small trees, 0.3–6.0 m tall. Bark smooth, brown or grey. Branchlets sparsely sericeous to villous, sometimes densely so, oil glands absent. Leaves concentrated near branch tips or mostly evenly distributed. Petioles 0.5–1 mm long, rounded, eglandular. Leaf blades

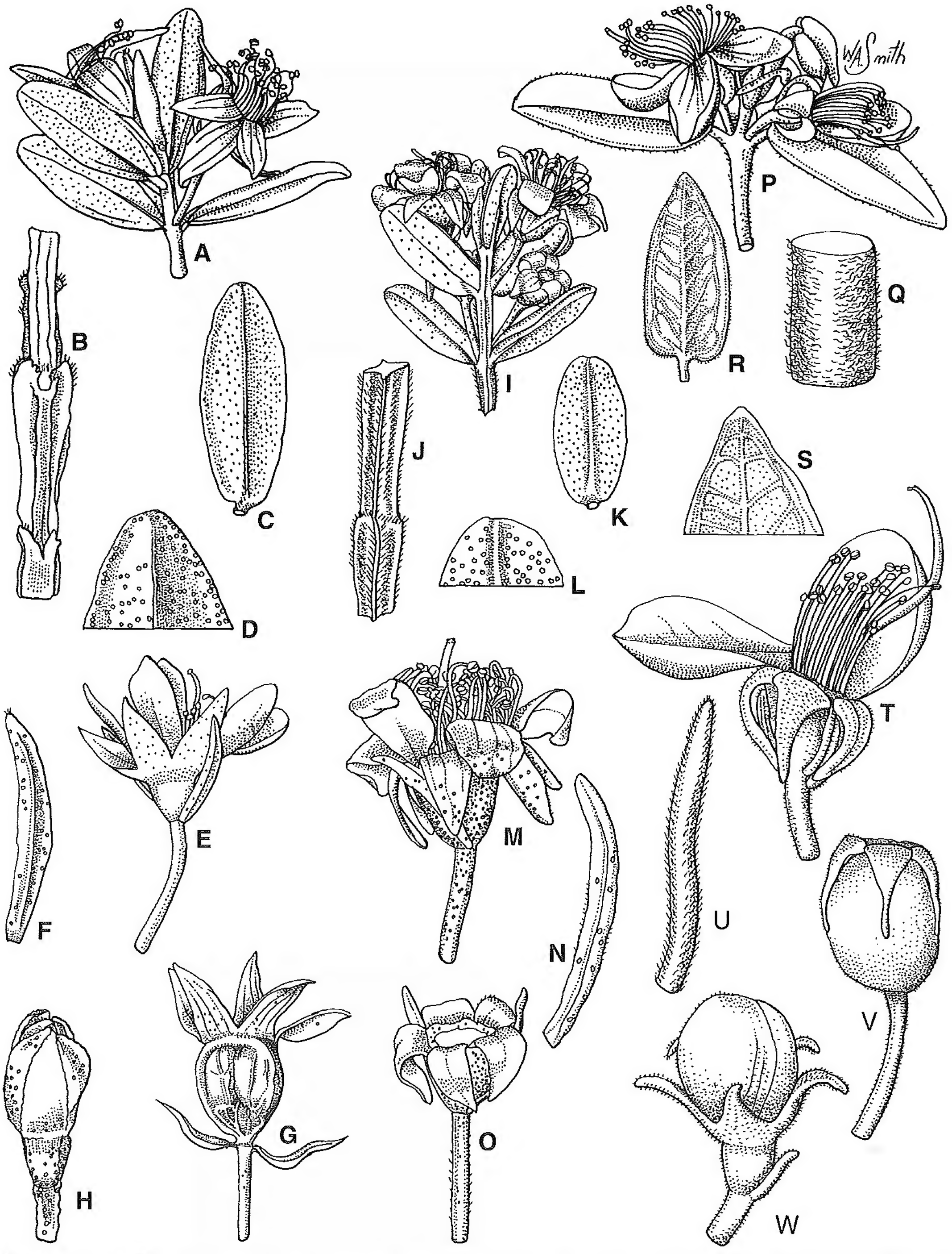

Figure 4. A–H: ***Myrtella beccarii.*** A. flowering branchlet × 3. B. section of branchlet × 8. C. adaxial leaf profile × 4. D. adaxial leaf apex × 8. E. flower × 4. F. bracteole × 8. G. fruit × 4. H. flower bud × 3. A,C,D,H: *Henty* LAE72969 (L). B: *Streimann* NGF44151 (BRI). E,F,G: *Bellamy* B6 (L). **I–O:** ***M. bennigseniana.*** I. flowering branchlets × 3. J. section of branchlet × 8. K. abaxial leaf profile × 4. L. adaxial leaf apex × 8. M. flower × 6. N. bracteole × 12. O. fruit × 12. I–O: *Rinehart* 12019 (BRI). **P–W: *Lithomyrtus cordata*.** P. flowering branchlet × 1.5. Q. section of branclet × 16. R. abaxial leaf profile × 1. S. adaxial leaf apex (hairs not shown) × 2. T. flower with front petals removed × 3. U. bracteole × 8. V. fruit × 2. W. flower bud × 3. P–W: *Snow* 7420 et al. (BRI).

elliptic to narrowly ovate, 3.5–5(–7) mm long, 2–2.5 mm wide, base truncate, free from the stem, apex obtuse, margins revolute, upper surface glabrous except for sericeous lower portion of midvein and young leaves, midvein impressed above, lower surface glabrous or sericeous on lower portion of midvein. Peduncles 2–5 mm long in flower. Bracteoles 2–3.5 mm long, 0.4–0.6 mm wide, glabrous or minutely and sparsely sericeous along edges. Sepal lobes 1.5–2 mm long, glabrous or sparsely short tomentose along edges. Petals white to pink, elliptic to ovate, 2–3 mm long; lower surface glabrous. Stamens uniseriate, c. 1.5 mm long; anther connectives glandular. Style 1.5–3 mm long, flexuous. Fruit globose, tapered at base, 1.5–3 mm long, 2.5–3 mm wide, brown to dark bluish-black when mature. Fig. 4I–O.

***Specimens examined*:** **Guam.** Savanna in Siqua Falls area, between Alutom & Tenjo ridges, Jan 1986, *Rinehart* LR12019 (BRI); Savanna along road (and pipeline) to OMNI on north spur from Fonte Plateau (Nimitz Hill), Sep 1985, *Rinehart* LR11544 (BRI); Savanna in Siqua Falls area, between Alutom and Tenjo ridges, Jan 1986, *Rinehart* LR12019 (BRI). **Indonesia.** IRIAN JAYA: Tablasoefoe, E of Village, Aug 1961, *van Royen & Sleumer* 6449 (BRI); Cycloop Mountains, southern slope of Makanoi Range, N of Kotanica, Jul 1961, *van Royen & Sleumer* 6211 (BRI); Cycloop Mountains, Arthur Hill, E slope, Jul 1961, *van Royen & Sleumer* 6161 (BRI); Hollandia [= Jayapura] and vicinity, Jun–Jul 1938, *Brass* 8887 (BRI); Jayapura, Böschung der Küstenstrasse im nordöstlichen Teil der Stadt, Feb 1976, *Hiepko & Shultze-Motel* 579 (L); Kota Nica, Hollandia, Oct 1956, *Schram* BW2844 (L); Town of Sukarnapura (= Hollandia), *Kostermanns & Soegeng* 560 (L); Cape Tanah Merah, Aug 1961, *van Royen & Sleumer* 6501 (L); “Base G”, Hollandia, Dec 1956, *Sidje* BW4126 (CANB, L); Cycloop Mts, along path to Near, *Meyer Dress* 138 (L); Cycloop Mts, foothills W of Koejaboe River and E of Hoebal River, *van Royen* 4149 (L); Jayapura, , Böschung der Küstenstrasse im nordöstlichen Teil der Stadt, Feb 1976, *Hiepko & Shultze-Motel* 509 (L). **Papua New Guinea.** Sewa Bay, Normanby Island, April 1956, *Womersley* NGF8687 (BRI); Normanby Island, Mt Pabinama, May 1956, *Brass* 25703 (L); Province Milne Bay, Subprovince Esa’ala, NE of Bwasiaiai, Dec 1977, *Croft & Marsh* LAE71203 (L); Along Arumu River S of Botue village, Sep 1953, *Hoogland* 3963 (BRI, L).

***Distribution and habitat*:** Indonesia, Papua New Guinea, Guam; also reported but not verified from Caroline and Mariana Islands. In open grasslands, occasionally in understorey of *Dacrydium* forests, on lateritic soils, between 20 and 2500 metres altitude.

***Phenology*:** Flowering March to September; fruiting March to October.

***Notes*:** The flowers of *M. bennigseniana* are white or pinkish. The reddish fruit dries to nearly black. The uniseriate, glandular stamens are reliable diagnostic attributes in flower as are the densely pubescent young twigs in sterile material. Reports of the species from the Caroline Islands (Merrill 1914; Diels 1922) and Mariana Islands (Diels 1921, 1922) have not been confirmed. The wide elevational range suggests the possibility of more than one taxon within this species as currently accepted.

***Conservation status*:** The relative few collections of this species and dearth of detailed information on specimen labels indicate the species is data deficient.

***Local name*:** ètèti (Orokaiva language, Mumuni; see *Hoogland* 3963 [BRI, L]).

Excluded species

Uromyrtus rostrata (Lauterb.) N.Snow & Guymer, **comb. nov.**

Myrtella rostrata Lauterb., Nova Guinea 8: 855(1912). **Type**: New Guinea. Hellwig Mountains, *Roemer* 1050 (holo: L, photo BRI).

The type specimen of *Myrtella rostrata* has the inflorescence, fruit and seed characters of *Uromyrtus* and is subsequently transferred to this genus.

Kania hirsutula (F.Muell.) A. J. Scott, Kew Bull. 45: 206 (1990); *Myrtella hirsutula* F.Muell., Descr. Notes Papuan Pl. 106 (1877); **Type:** Indonesia. Irian Jaya. Mount Arfak, Jul 1875, *Beccari* 3776 (lectotype, here designated: FI).

According to Article 37.3 of the International Code of Botanical Nomenclature (Greuter et al., 1994), sufficient information was provided by Mueller (1877) to indicate a holotype. However, given that Mueller loc. cit. did not cite a collection number of Beccari’s in the protologue and that Scott (1990) indicated no specimen can be found in the National Herbarium of Victoria, Melbourne on which Mueller might have based his description, lectotypification here eliminates ambiguity surrounding the possible existence of a putative holotype implied by Scott's (1990) citation of an isotype. Scott loc. cit. provides irrefutable evidence for transferring *Myrtella hirsutula* to the genus *Kania*.

Lithomyrtus F.Muell., J. of Bot. and Kew Gard. Misc. 9: 228 (1857). **Type:** *Lithomyrtus hypoleuca* F.Muell. ex N.Snow & Guymer, lecto: here designated.

Fenzlia Endl., Atakta Bot. 19. 1834, nom. illegit. non *Fenzlia* Benth., Bot. Reg. sub t. 1622. 1833. **Type:** *Fenzlia obtusa* Endl. (lecto:fide Scott 1978)

Frutices prostrati usque plerumque erecti vel raro arbusculae, folia juvenia et rami villosi usque tomentosi, saepe minus hirsuti vetustatibus. Stipulae parvae at prominentes, pilorum 2 aliquot ferrugineorum setosorum consistentes. Bracteolae non foliosae, absque costis distinctis. Flores solitarii in axillis foliorum. Sepala petalaque pentamera, lobi sepalorum in alabastro seorsi, stamina multiseriata, numerosa. Fructus baccam vel baccatus. Ovarium maturitate plerumque solitarium. Semina plerumque 2 vel 3, oblique conferruminata, testa lignea. Embryo circinatus, cotyledones tenues, circinatae, apex radiculae incrassatus, ultra embryonem extendens.

Plants suffrutescent, shrubs or small trees, 0.2–5 m tall, stems prostrate, ascending or erect. Bark smooth or stringy, brown, grey to somewhat orange-coloured. Branchlets rounded, glabrous to tomentose, oil glands present and prominent or absent. Leaves decussate, opposite or rarely whorled at some nodes, evenly distributed or concentrated near growing tips, coriaceous to velvety. Stipules of 2–several free, ferruginous, setose hairs. Petioles channelled or rounded, eglandular or rarely glandular. Leaf blades linear to elliptic, ovate or sometimes obovate; margins flat or revolute; bases truncate, cordate or cuneate, occasionally clasping the stem; apex obtuse, retuse or acute, adaxial surface glabrous to tomentose with midvein impressed; lower surface glabrous to tomentose, marginal veins of lower surface prominent, indistinct or absent. Inflorescence a solitary axillary flower. Peduncles rigid or sometimes flexuous, sparsely antrorsely sericeous to villous or tomentose. Bracteoles lacking a midrib, ascending, scale-like, slightly curved to straight, exceeding or shorter than base of sepal lobes, sparsely sericeous to densely villous or tomentose, persistent or caducous in fruit. Hypanthium obconic, densely sericeous to tomentose. Sepals 5, fused at the base. Sepal lobes imbricate in bud, apex acute to acuminate, sparsely sericeous to tomentose, persistent in fruit, held above or reflexed towards fruit. Petals 5, white, pink or magenta, elliptic to ovate or obovate. Stamens numerous, multiseriate, included, folded centripetally in bud. Staminal disk hairy. Anthers subglobose, dorsifixed, versatile, less than ¼ length of filaments, dehiscing by longitudinal slits, connectives glandular or eglandular. Ovary 1-locular, ovules (1 or) 2 (or 3) per locule, placentation parietal. Style 1, flexuous or mostly straight, glabrous or sparsely sericeous. Stigma 1, terete, rarely capitate. Fruit a hard berry with bony, tightly fused seeds, subglobose to cylindrical or sometimes fusiform, base rounded or tapered, glabrous to tomentose, light yellow or olive-green, or whitish by dense pubescence. Seed coat hard, bony. Adjacent seeds tightly fused, their boundaries in longitudinal section generally indistinct and often somewhat oblique to the long axis of fruit. Embryo circinate. Radicle relatively long, relatively thin, swollen near tip, the tip held at same horizontal plane as embryo or spirally contorted above or below. Cotyledons circinate, relatively long, shorter than hypocotyl, relatively thin, not folded back towards hypocotyl. Tropical Australia (Western Australia, Northern Territory, Queensland).

All Australian species formerly in *Myrtella* are now assigned to *Lithomyrtus*, which is confined to the North Australian Province of the Northeast Australian Region (Takhtajan 1986).

***Notes*:** Leaves of *L. retusa* seedlings under a metre tall are generally longer than those of mature plants (Snow, pers. obs.) and the possibility of heteromorphy between juvenile and adult leaves needs further investigation. The black hair-like structures occasionally occurring on the foliage of some species (particularly *L.*

obtusa) are actually an ophiostimoid fungus (J. Simpson, pers. comm.).

The outer layers (perisperm) of the mature fruit of this genus typically disintegrate, leaving as a single diaspore the hard, fused seeds. The individual seed coats often have openings (opercula) from which the radicles probably emerge during germination of the seed.

Most plants with mature fruit of all *Lithomyrtus* species show evidence of some insect predation. A preliminary identification of insect casings and pupae found on their leaves and fruits shows these insects represent two families (P. Gullan, pers. comm.). The first of these families, Diaspididae (armoured scale insects), consist of insects phytophagous on a variety of plant parts, including fruits. The second, family Tachinidae (tachinid flies), comprises mostly parasites of other insects. Whether either insect is actually attacking the fruits of this genus however, is unknown. A single moth pupa was found embedded in a fruit of *L. hypoleuca* but it was insufficiently mature for identification to family level (J. Lawrence, pers. comm.). Investigation of fruit predation therefore would appear to be a worthwhile field study, particularly in the Kakadu region of the Northern Territory where several *Lithomyrtus* species coexist.

The ornamental potential of the genus is well known (Hubbard 1978) and evaluations of this aspect is currently in progress at the Darwin Botanical Garden (G. Leach, pers. comm.). Potential horticultural disadvantages observed in the field include insect and fungal attack on *L. grandifolia* and ophiostemoid fungal infection occasionally noted on other species, most notably *L. obtusa*. Attempts to germinate mature seeds of seven species representing several accessions for each were unsuccessful.

Key to species of *Lithomyrtus*

1. Leaves linear, 10–51 mm long and 1–3 mm wide; Northern Territory .... **7. L. linariifolia**
   Leaves narrowly elliptic to ovate or obovate 2

2. Leaves 26–61 mm long, 10–46 mm wide; Northern Territory .... **4. L. grandifolia**
   Leaves mostly less than 25 mm long and less than 20 mm wide 3

3. Leaf bases cordate 4
   Leaf bases truncate or cuneate 6

4. Plants prostrate; peduncles in fruit often longer than subtending leaves; Northern Territory .... **10. L. repens**
   Plants erect; peduncles in fruit generally shorter than subtending leaves 5

5. Base of leaf blades clasping stem; petiole up to 0.5 mm; leaves mostly eglandular abaxially; Northern Territory .... **6. L. kakaduensis**
   Base of leaf blades free from stem; petiole mostly greater than 1 mm long; leaves always glandular abaxially; Northern Territory .... **1. L. cordata**

6. Plants prostrate; Northern Territory .... **10. L. repens**
   Plants erect 7

7. Leaves less than 30 mm long and less than 2 mm wide; Queensland .... **8. L. microphylla**
   Leaves mostly longer than 30 mm and greater than 2 mm wide 8

8. Leaf blades eglandular abaxially (rarely glandular in *L. hypoleuca* and *L. obtusa*) 9
   Leaf blades glandular abaxially 11

9. Leaf blades narrowly elliptic; tips of sepal lobes mostly held above fruit; Northern Territory .... **3. L. dunlopii**

Leaf blades broadly elliptic to ovate or obovate; tips of sepal lobes reflexed and held adjacent to fruit 10

10. Bracteoles not exceeding base of sepal lobes in flower; anther connectives eglandular; lateral abaxial leaf veins invisible; Northern Territory, Queensland .... **5. L. hypoleuca**
Bracteoles exceeding base of sepal lobes in flower; anther connectives glandular; lateral abaxial leaf veins clearly visible; Northern Territory, Queensland .... **9. L. obtusa**

11. Oil glands often inconspicuous (use magnification); plants usually less than 1 m tall; foliage relatively dense and mostly evenly distributed on stems; petioles not channelled adaxially; tips of sepal lobes mostly erect; Northern Territory .... **2. L. densifolia**
Oil glands visible without magnification; plants usually greater than 1 metre tall; foliage not dense and often concentrated near branch tips; petioles channelled adaxially; tips of sepal lobes reflexed 12

12. Foliage oil glands ferruginous, unequal in size; leaf blades narrowly elliptic to elliptic or obovate, cuneate at base; petals 3–6 mm long; anther connectives usually with several glands; fruit globular to subglobular, 3–6 mm long, glabrous to sparsely villous; Western Australia, Northern Territory, Queensland .... **11. L. retusa**
Foliage oil glands yellow-green, equal in size; leaf blades narrowly ovate to ovate, cordate or truncate at base; petals 7–12 mm long; anther connectives usually with a single gland; fruit subcylindrical, 7–12 mm long, sparsely tomentose to tomentose; Northern Territory .... **3. L. cordata**

1. Lithomyrtus cordata (A.J. Scott) N.Snow & Guymer **comb. nov.**

Myrtella cordata A.J. Scott, Kew Bull: 33: 301 (1978). **Type:** Australia. Northern Territory. DARWIN AND GULF REGION: Deaf Adder Basin, 10 Jun 1972, *R. Schodde* AE81 (holo: K; iso: CANB, DNA, L, NT).

Erect shrubs to small trees, 1–5 m tall. Bark smooth or stringy, brown, grey or orangish. Branchlets tomentose, oil glands present and prominent or absent. Leaves opposite, mostly concentrated near branch tips, soft, hairy, petioles 1.5–6 mm long, channelled, adaxially eglandular or glandular. Leaf blades narrowly ovate to ovate, 12–48 mm long, 5–26 mm wide, base often cordate or occasionally truncate, apex obtuse or acute, margins revolute, adaxial surface sparsely short villous, glabrescent, midvein impressed, adaxial surface shortly and densely tomentose, glands of lower surface visible and about the same size, marginal veins of lower surface prominent (usually), or invisible or indistinct (occasionally). Peduncles rigid, 3–14 mm long, tomentose. Bracteoles 4–5 mm long, c. 0.5 mm wide, the tips (in flower) not exceeding base of sepal lobes, or rarely exceeding base of sepal lobes, tomentose, persistent in fruit. Hypanthium tomentose. Sepal lobes 2.5–4.5 mm long, apex mostly acuminate or rarely acute, villous or tomentose, persistent in fruit, mostly reflexed towards body of fruit. Petals white to magenta, elliptic to ovate or obovate, 8–13 mm long, upper surface glabrous, glabrescent or sparsely sericeous, lower surface sericeous to villous. Stamens 5–9 mm long, anther connectives glandular. Style 9–14 mm long, flexuous, sparsely sericeous. Fruit subcylindrical, base rounded, 7–12 mm long, 6–9 mm wide, sparsely tomentose to tomentose, yellow-green or olive-green to whitish. Peduncle 3–14 mm long in fruit. Radicle tip somewhat spirally contorted above or below plane of embryo. Fig. 4P–W.

***Selected specimens*: Northern Territory.** DARWIN AND GULF DISTRICT: Headwaters East Alligator River, 12°47'S, 133°21'E, May 1997, *Guymer* 2503 et al. (BRI, DNA, CANB); Arnhem Land, edge or Wellington Range, c. 40

km SSE of Murganella settlement, 11°49'34.7"S, 133°03'15.3"E, May 1997, *Snow & Mangion* 7420 (AD, BRI, CANB, DNA, K, NSW, MEL, MO, PERTH); Kakadu N.P., ca 25 km NE of Jabiru, 12°30'30.4"S; 132°57'08.1"E, May 1997, *Snow* 7437 et al. (BRI, CANB, DNA, L, MO, US); Head of Koolpin Creek, 13°26'06"S, 132°39'13"E, Apr 1995, *Leach* 4382 & *Greshke* (DNA); Kakadu N.P., Mt Brockman, c. 16 km SE of Jabiru, 12°47'37.8"S, 132°55'42.9"E, May 1997, *Snow* 7447 et al. (BRI, CANB, DNA, L. NSW, PERTH); 1–2 miles S [of] Cannon Hill, Aug 1972, *Martenz* AE261 (BRI, DNA); East Alligator River near Cahills Crossing on road to Oenpelli, 12°27'S, 132°58'E, Jun 1974, *Pullen* 9446 (BRI, CANB, DNA, MEL); 10 km W [of] Island Lagoon, Mudginberry Stn, May 1976, *Brown* s.n. (BRI); Arnhem Land, Magela Creek upper catchment, 12°49'19"S, 133°00'25"E, Apr 1995, *Cowie* 5608 & *Brennan* (BRI, DNA); Deaf Adder Gorge, 13°07'S, 132°56'E, Apr 1980, *Dunlop* 5466 (AD, BRI, CANB, DNA); Little Nourlangie Rock, 12°52'S, 132°48'E, Aug 1978, *Dunlop* 5005 (BRI, CANB, DNA, MEL); Kakadu N.P., Twin Falls, 13°19'S, 132°50'E, Sep 1980, *Dunlop* 5539 (BRI CANB, MEL); c. 4 miles NNE of Mudginberry HS, Jul 1972, *Lazarides* 7526 (BRI, CANB); 3 km S of Naradge Ck crossing, 500 m W of Oenpelli Road, 12°28'S, 132°53'E, May 1988, *Bishop* 840 (DNA); Jabiluka Lease, sandstone outcrop at north end, 12°29'S, 132°54'E, Jun 1992, *Taylor* 103 (DNA); 11.5 km NE of Jabiru E, 12°35'S, 132°58'E, May 1980, *Craven* 5939 (CANB, DNA); Arnhem Land, sources of Goomadeer River, 12°34'S, 133°23'E, Jun 1978, *Henshall* 1987 (DNA); 25 km from Jabiru towards Oenpelli, 12°32'S, 132°55'E, May 1988, *Munir* 5771 (DNA); 16 km SW of East Alligator River crossing, 12°28'S, 132°55'E, Jun 1972, *Maconochie* 2273 (DNA); Koongarra Saddle, Kakadu N.P., 12°51'S, 132°51'E, Aug 1985, *Wightman* 2032 (DNA); Nabarlek, 12°19'S, 133°19'E, Jun 1988, *Hinz* 34 (DNA); Kakadu N.P., Upper Gimbat Creek, 13°34'S, 133°00'E, Apr 1990, *Cowie* 1151 & *Leach* (BRI, DNA, MEL); Koongarra Jump-up, 12°51'S, 132°50'E, May 1978, *Rice* 2617 (CANB); 17.5 km NE of Jim Jim Falls, 13°08.5'S, 132°56'E, May 1980, *Craven* 6108 (CANB).

Distribution and habitat: Darwin and Gulf Region, Northern Territory. Growing in rocky areas amongst the escarpments and slopes of Kakadu National Park and in Arnhem Land, in sandy or rocky soils.

Phenology: Flowering mostly April to July; fruiting May to November.

Notes: Plants of *Lithomyrtus cordata* are the tallest-growing in the genus. Their leaf shape varies from broadly ovate to narrowly ovate or almost elliptic with bases truncate or cordate. This is the only species of *Lithomyrtus* typically having both abaxial leaf glands and prominent abaxial lateral veins, although the latter are not always conspicuous. This combination also occurs rarely in *L. obtusa* but these species are allopatric. The ferruginous foliage glands on *Gittins* 2886 (BRI, CANB) from near the East Alligator River suggests hybridisation with *L. retusa*. Several of the specimens cited by Scott (1978) as paratypes of *Myrtella cordata* have been found to belong to other species of *Lithomyrtus*.

Conservation status: The species is widespread and can be locally common.

2. Lithomyrtus densifolia N.Snow & Guymer, **sp. nov.** Plantae erectae, plerumque minores quam 1 metrum altae, in ambitu rotundatae, dense foliosae ramosaeque. Folia anguste elliptica, subtus glandes inconspicuas et venas secundarias laterales prominentes gerentia. Fructus plerumque cylindrici, glabri usque sparse tomentosi. **Typus:** Australia. Northern Territory. Darwin and Gulf Region: Upper East Alligator River, Arnhem Land, 12°49'30"S, 133°21'59"E, 13 May 1997; *C. Mangion* 400 & *P.S. Short* (holo: DNA; iso: AD, BRI, CANB, CHR, K, HO, L, NSW, MEL, GREE, MO, PERTH, UPS, US [Note: type material represents either of the two genotypes collected, indicated on labels as A collection or B collection]).

Mostly erect, compact, densely branching shrubs, 0.3–1 (–1.5) m tall. Bark stringy, orangish or brown. Branchlets tomentose, oil glands lacking. Leaves opposite, evenly distributed, soft (younger) or coriaceous (older). Petioles 1–1.5 mm long, rounded, eglandular or glandular. Leaf blades narrowly elliptic, 6–15(–20) mm long, 1.5–3.5 mm wide, base cuneate, free from the stem, apex obtuse, margins revolute or flat, upper surface glabrescent or sparsely short- villous, adaxial midvein impressed, lower surface villous to densely villous, oil glands of lower surface visible and about the same size (but usually faint), marginal veins of lower surface invisible or indistinct. Peduncles rigid, 5–12 mm long, villous. Bracteoles 3–5 mm long 0.5–0.7 mm wide, the tips (in flower) not exceeding base of sepal lobes, villous to tomentose, caducous in fruit. Hypanthium tomentose. Sepal lobes 2.5 mm long; apex acute, tomentose, persistent in fruit, mostly ascending and above body of fruit. Petals pink to magenta, ovate to obovate, 5–8.5 mm long, upper surface mostly glabrous, lower surface sericeous to villous. Stamens 2–7 mm long, anther connectives glandular. Style 5–8 mm long, flexuous, glabrous. Fruit cylindrical or rarely fusiform, base rounded or tapered, 6–10 mm long, 3–5.5 mm wide, glabrescent to sparsely tomentose, yellow-green or olive-green. Radicle tip spirally contorted above or below plane of embryo, or held at same horizontal plane as embryo. Fig. 5A–G.

***Selected specimens*: Northern Territory**. DARWIN AND GULF REGION: Arnhem Land, 15 km SE of Jabiru, 12°47'S, 132°56'E, Apr 1989, *Johnson* 4770 (BRI); Kakadu N.P., 14.9 km (by road) from Pine Creek/Jabiru road (Kakadu Hwy), on road to Koongarra Saddle, c. 16.3 km S of Jabiru, 12°50'S, 132°51'E, May 1992, *West* 5311 (CANB, DNA); Mt. Gilruth area, in sand amongst rocks on sandstone escarpment, 12°58'S, 133°10'E, Jun 1978, *Dunlop* 4877 (DNA, PERTH); Koongarra area, 1 km S of jumpup, 12°51'S, 132°51'E, Apr 1979, *Rankin* 1981 (BRI, DNA); Kakadu N.P., 6 km SW of Mt. Brockman, 12°46'S, 132°54'E, Apr 1980, *Telford* 8086 & *Wrigley* (CANB); Headwaters of the Liverpool River, Arnhem Land, 12°46'S, 133°44'E, Apr 1984, *Wightman* 1444 & *Craven* (BRI, CANB, DNA); Headwaters East Alligator River, 12°47.76S, 133°21.61S, May 1997, *Guymer* 2505 et al. (BRI, DNA, CANB); Kakadu N.P., Little Nourlangie Rock, 12°52'S, 132°47'E, Aug. 1980, *Telford* 8459 & *Wrigley* (CANB); Vicinity of Nourlangie Rock, Jul 1972, *Martensz* AE114 (DNA); Giddy River area, Gove, Oct 1971, *Hinz* 71–1610B (DNA); Arnhem Land, 12°54'S, 135°27'E, Jun 1972, *Latz* 2957 (CANB, DNA); Doyndji area, 12°55'S, 135°24'E, Oct 1976, *Scarlett* 30 (DNA); 1.5 km NE of Koongarra, 12°52'S, 132°51'E, Sep 1978, *Rankin* 1390 (CANB, DNA); Mt. Brockman, 12°46'S, 132°54'E, Apr 1980, *Dunlop* 5490 (CANB, DNA); Koongarra Saddle, NE of Nourlangie Rock, 12°51'S, 132°52'E, May 1988, *Munir* 5750 (DNA); Upper East Alligator River, Arnhem Land, 12°49'S, 133°21'E, Apr 1988, *Russell-Smith* 5226 & *Lucas* (DNA); c. 17 km SE of Jabiru, 12°47.5'S, 132°57.5'E, *Craven* 6595 (CANB, DNA, MEL); Buffalo Springs, Mt. Brockman, 5 km NE of Koongarra, 12°50'S, 132°53'E, May 1980, *Lazarides* 8910 (CANB, DNA); Arnhem Land, Magela Creek upper catchment, 12°49'02"S, 133°00'19"E, Apr 1995, *Cowie* 5672 & *Brennan* (CANB, DNA); Kakadu N.P., Mt. Brockman, 12°50'00"S, 132°55'17"E, Mar 1995, *Egan* 4624 (DNA); Kakadu N.P., 12°50'S, 132°51'E, May 1988, *Munir* 5717 (DNA); Kakadu N.P., Mt. Brockman area, 12°48'S, 132°54'E, Mar 1995, *Russell-Smith* 10239 (DNA); Kakadu N.P., Koongarra Saddle, 12.51S, 132.51E, Nov 1991, *Leach* 2904 & *Dunlop* (CANB, DNA); Little Nourlangie Rock, 12°52'S, 132°48'E, Mar 1979, *Dunlop* 4948 (CANB, DNA); Near Koongarra Saddle, 1.5 km N of Koongarra, 12°51.5'S, 132°51.5"E, May 1980, *Craven* 5717 (CANB, DNA); Mt. Gilruth, Feb 1977, *Dunlop* 4431 (CANB); Kakadu N.P., Little Nourlangie Rock, 12°52'S, 132°47'E, Apr 1980, *Telford* 7789 & *Wrigley* (CANB); Koongarra, 12°51'S; 132°52'E, May 1978, *Rice* 2637 (CANB).

Distribution and habitat: Northern Territory; Darwin and Gulf Region. Sandstone escarpments, scree slopes and ledges, in open shrublands; soils skeletal or sandy.

Phenology: Flowering February to June; fruiting April to November.

Notes: *Lithomyrtus densifolia* and *L. dunlopii* are distinct in the field but herbarium material can be very similar in appearance. In the field, *L. densifolia* is a compact, spreading, densely branching shrub usually less than a metre tall, with abundant grey-green leaves occurring densely throughout whereas *L. dunlopii* is a straggly, openly branching shrub to 1.5 m. The peduncles of mature fruits of *L. dunlopii* generally exceed 10 mm in length, whereas those of *L. densifolia* are usually shorter than 10 mm. The fruits of *L. densifolia* are highly aromatic when crushed.

Conservation status: Although the species is not locally common, its wide distribution does not suggest any vulnerability at this time.

Etymology: The specific epithet is derived from Latin and refers to the close spacing of the leaves.

3. Lithomyrtus dunlopii N.Snow & Guymer **sp. nov.** Plantae erectae. Folia anguste elliptica, venis secundariis lateralibus prominentibus plerumque carentia. Pedunculi fructum folia plerumque paulo longiores. Fructus cylindrici, raro fusiformes, sparse villosi. **Typus:** Australia. Northern Territory: Arnhem Land, along mostly abandoned track c. 7.1 km NE of Murganella Settlement, 11°32'08.7"S, 132°56'13.7"E, May 1997, *N.Snow* 7419 & *C.Mangion* (holo: DNA; iso: BRI, CANB, K, L, MEL, MO, NSW, US).

Erect shrubs 0.7–1.5 (–2) m tall. Bark stringy, brown or orangish. Branchlets villous or tomentose, oil glands lacking. Leaves opposite, mostly evenly distributed, soft but becoming coriaceous. Petioles 1.5–4 mm long, rounded, eglandular. Leaf blades narrowly elliptic, 10–40(–55) mm long, (3–)6–10 mm wide, base narrowly cuneate, free from the stem, apex obtuse, margins revolute or flat, upper surface glabrescent to sparsely short villous, adaxial midvein impressed, lower surface villous to tomentose, oil glands of lower surface not visible, marginal veins of lower surface invisible or indistinct. Peduncles rigid, sparsely villous to villous, 10–30 mm long. Bracteoles 3–3.6 mm long, c. 0.5 mm wide, tips (in flower) exceeding base of sepal lobes or not, tomentose, caducous in fruit. Hypanthium tomentose. Sepal lobes 1.5–3.3 mm long; apex acute or acuminate, sparsely tomentose to tomentose, persistent in fruit, mostly ascending and above body of fruit. Petals white to magenta, ovate to broadly ovate, 5.5–6.8 mm long, upper surface sparsely sericeous, lower surface tomentose. Stamens 4–5 mm long; anther connectives glandular. Style 4–5 mm long, flexuous or mostly straight, glabrous or sparsely sericeous. Fruit cylindrical or rarely fusiform, base tapered, 7–10 mm long, 4–5.5 mm wide, sparsely villous, yellow-green or olive-green. Radicle tip somewhat spirally contorted above or below plane of embryo. Fig. 5H–N.

***Selected specimens*: Northern Territory.** DARWIN AND GULF REGION: Arnhem Land, along track bearing east-west towards Gningarg Point, from Murganella settlement, 11°28’30.8”S; 132°56’31.6”E, May 1997, *Snow* 7418 *& Mangion* (BRI, CANB, DNA, K, L, NSW, MO, PERTH, US); Kakadu N.P., c. 25 km NE of Jabiru, 12°29’58.3”S; 132°56’52.0”E, May 1997, *Snow* 7441 *et al.* (BRI, CANB, DNA, NSW, K, MO); Arnhem Land, edge of Wellington Range, c. 40 km SSE of Murganella settlement, 11°49’34.7”S; 133°03’15.3”, May 1997, *Snow* 7421 *& Mangion* (BRI, UPS); Kakadu N.P., 6.5 km SSW of Mt. Brockman, 12°48’S, 132°56’E, *Telford* 8040 *& Wrigley* (CANB); Arnhem Land, Flinders Peninsula, 12°06’S, 135°59’E, May 1992, *Cowie* 2768 (DNA,MEL); c. 22 km NE of Jabiru, 12°31’S, 132°58.5’E, Mar 1981, *Craven & Whitbread* 6604 (CANB,DNA,MEL); Upper Liverpool River, 12°26’S, 134°04’E, Sep 1976, *Duncan* s.n. (DNA); Kakadu N.P., near Cannon Hill, 12.29S, 132.55E, Mar 1983, *Russell-Smith* 522 (DNA); 15 km NNE of Jabiru East, 12°32’S, 132°57’E, Jun 1980, *Craven* 6458 (DNA); Headwaters of East Alligator River, Arnhem Land, 12°48’S, 133°21’E, Mar 1984, *Wightman* 1376 *& Craven* (BRI, CANB, DNA); Nabarlek, 12°17’S, 133°19’E, Apr 1979, *Rankin* 2093 (BRI, CANB, DNA); Mt. Brockman, 12°45’S, 132°56’E, Apr 1980, *Dunlop* 5501 (CANB, DNA); Upper East Alligator River, Arnhem Land, 12.50S, 133.20E, Apr 1988, *Russell-Smith* 5268 *& Lucas* (BRI, DNA); c. 8 km NNE of Jabiru, 12°35’53”S, 132°59’34”E, Apr 1995, *Egan* 4826 (BRI, CANB, DNA); 11.5 km NE of Jabiru East, 12°35’S, 132°58’E, May 1980, *Craven* 5938 (CANB, DNA); Arnhem Land, Murganella Settlement, vicinity and west of Workshop Road, 11°32’48.3”S, 132°55’25.3”E, May 1997, *Snow* 7414 *& Mangion* (BRI, DNA, L, UPS); Kakadu N.P., c. 25 km NE of Jabiru, 12°30’24.9”S, 132°57’05.5”E, *Snow* 7432 et al. (BRI, DNA); Giddy River area, Gove, Oct 1971, *Hinz* 71–1610B (CANB, DNA); Nabarlek, 12.20S, 133.16E, *Hinz* 46 (DNA); North Caledon Bay, Oct 1968, *Byrnes* NB964 (DNA); Gimbat River Station, source of South Alligator River, 13°45’S, 132°38’E, Jul 1983, *Russell-Smith* 748 (DNA); 15 km NNE of Jabiru East, 12°32’S, 132°57’E, Jun 1980, *Craven* 6458 (CANB); Cato River Rd, 6.5 km N Dahlinbury turnoff, 12°21’S, 136°25’E, Sep 1987, *Clark* 1694 (DNA); Marchinbar Island South, Hopeful Bay, 11°25’38”S, 136°29’60”E, Sep 1994, *Brennan* 2900 (DNA); Wessel Islands, 11°26’S, 136°31’E, Oct 1972, *Latz* 3480 (DNA).

***Distribution and habitat*:** Northern Territory; Darwin and Gulf Region. Occurs in heaths, woodlands or *Allosyncarpia ternata* S.T.Blake forests, along sandstone escarpments and outcrops; soils sandy or lateritic.

***Phenology*:** Flowering April to August; fruiting April to November.

***Notes*:** *L. dunlopii* most resembles *L. densifolia.* The tips of the bracteoles of *L. dunlopii* occasionally exceed the base of the sepal lobes (e.g., *Russell-Smith* 5381 & *Lucas* (BRI); *Egan* 4826 (BRI)), an attribute which otherwise usually occurs only in *L. obtusa*. However, the known distributional ranges of *L. dunlopii* and *L. obtusa* do not overlap. A few specimens of *L. dunlopii* with narrowly elliptic leaves approach *L. linariifolia* (*Egan* 4826 [BRI]), but the dense pubescence on the abaxial leaf surface distinguishes them from the latter. The three specimens (*Clark* 1694, *Brennan* 2900, *Latz* 3480) need further study; they resemble specimens of *L. densifolia*, but are tentatively placed under *L. dunlopii* here because oil glands are not clearly visible on the abaxial leaf surfaces.

***Conservation status*:** The frequent occurrence of subpopulations in excess of fifty individuals, recruitment of seedlings in extant subpopulations (Snow, pers. obs.) and the known number of collections indicate this species is not of conservation concern at this time.

***Etymology*:** The specific epithet honours Clyde Dunlop of the Northern Territory Herbarium,

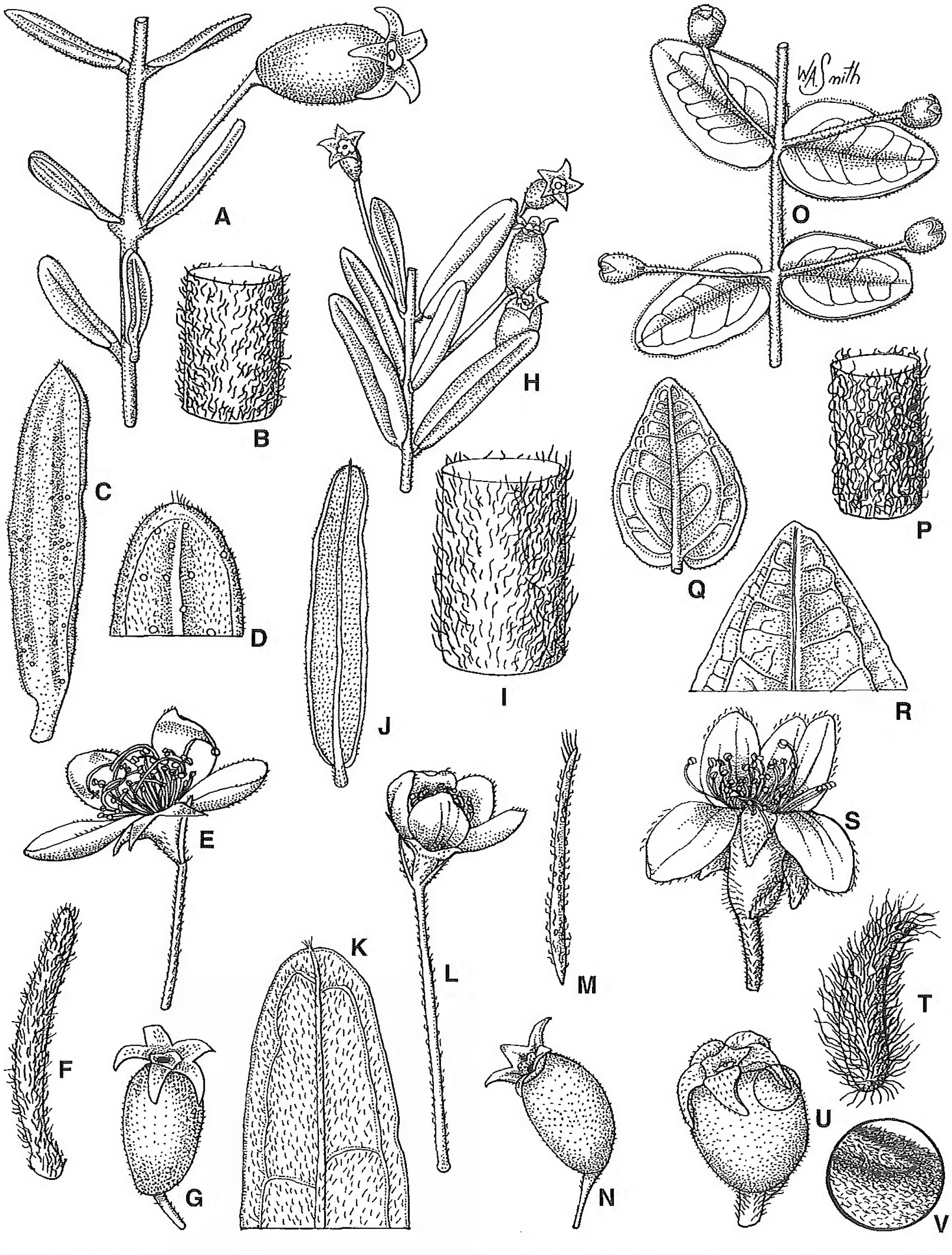

Figure 5. A–G: *Lithomyrtus densifolia*. A. fruiting branchlet × 2. B. section of branchlet × 16. C. abaxial leaf profile × 4. D. adaxial leaf apex × 8. E. flower × 2. F. bracteole × 8. G. fruit × 2. A–D, G: *Mangion* 400B *& Sharp*. E–F: *Russell-Smith* 10239. **H–N: *L. dunlopii*.** H. fruiting branchlet × 1. I. section of branchlet × 16. J. abaxial leaf profile × 2. K. adaxial leaf apex × 6. L. flower and peduncle × 2. M. bracteole × 8. N. fruit × 2. H–N: *Snow* 7419 *et al.* **O–Y: *L. grandifolia*.** O. fruiting branchlet × 0.5. P. section of branchlet × 8. Q. abaxial leaf profile × 0.5. R. adaxial leaf apex × 1. S. flower × 2. T. bracteole × 8. U. fruit × 1.5. V. detail of sepal lobe and fruit × 4. O–P: *Snow* 7444–B *et al.* Q–R, U–V: *Snow* 7443 *et al.* S–T: *Wightman* 1377 *& Craven*. All DNA.

who has made many important collections of this taxon and other species of *Lithomyrtus*.

4. Lithomyrtus grandifolia N.Snow & Guymer **sp. nov.** Plantae adscendentes usque erectae. Folia magna, late elliptica usque ovata, basibus cordatis autem haud amplexicaulibus; pagina inferior foliorum dense hirsuta, venas secundarias laterales prominentes gerens sed glandibus carens. Fructus subglobosi usque globosi, dense tomentosi. **Typus:** Australia. Northern Territory. DARWIN AND GULF REGION: Kakadu National Park, c. 25 km NE of Jabiru, underneath overhang of large sandstone outcrop, 12°29'12.2"S, 132°56'37.8"E, 15 May 1997, *N.Snow* 7444 et al. (holo: DNA; iso: BRI, CANB, K, L, MO).

Shrubs 0.6–2 m tall, stems erect (or merely ascending). Bark stringy, orangish. Branchlets tomentose, oil glands lacking. Leaves opposite, mostly evenly distributed, soft. Petioles 1.8–4 mm long, channelled, eglandular. Leaf blades ovate, (17–)25–61 mm long, 10–46 mm wide, base cordate, clasping (occasionally, especially the youngest leaves) or free from the stem, apex obtuse to acute (rarely), the margins flat, upper surface glabrescent to sparsely tomentose, adaxial midvein impressed, lower surface tomentose, glands of lower surface not visible, marginal veins of lower surface prominent. Peduncles rigid, 9–51 mm long in flower, villous to tomentose. Bracteoles 4–6 mm long, c.1 mm wide, tips (in flower) not exceeding base of sepal lobes, densely villous to tomentose, persistent in fruit. Hypanthium tomentose. Sepal lobes 4–7 mm long, apex acuminate, villous to tomentose, persistent in fruit, mostly reflexed towards body of fruit. Petals pink, elliptic to ovate, or obovate, 9–11 mm long, upper surface glabrous, lower surface villous to tomentose. Stamens 6–8 mm long; anther connectives eglandular. Style 5–7 mm long, flexuous, glabrous. Fruit mostly globose, base rounded, 11–13 mm long, 8–10 mm wide, tomentose, whitish. Radicle tip not spirally contorted, held at same plane as embryo. Fig. 5O–Y.

***Specimens examined*: Northern Territory.** DARWIN AND GULF REGION: Kakadu N.P., c. 25 km NE of Jabiru, 12°30'15.2"S, 132°57'08.6"E, May 1997, *Snow* 7430 et al. (BRI, DNA); Kakadu N.P., c. 25 km NE of Jabiru, near top of sandstone cliff arising some 20 metres, 12°30'38.7"S, 132°57'06.4"E, *Snow* 7439 et al. (BRI, DNA, MEL, PERTH, UPS); Kakadu N.P., c. 25 km NE of Jabiru, deeply dissected sandstone crevices, 12°30'30.4"S, 132°57'08.1"E, *Snow* 7438 et al. (BRI, DNA, GREE, NSW, US); Kakadu N.P., c. 25 km NE of Jabiru, 12°30'24.9"S, 132°57'05.5"E, *Snow* 7433 et al. (BRI); Kakadu N.P., remote area c. 25 km NE of Jabiru, 12°30'15.2"S, 132°57'08.6"E (BRI, DNA); Kakadu N.P., c. 25 km NE of Jabiru, very base of vertical sandstone outcropping in sandy soil, 12°29"28.5"S, 132°56'40.8"E, May 1997, *Snow* 7442 et al. (BRI, DNA, CANB, K, L, MO); Kakadu N.P., c. 25 km NE of Jabiru, underneath overhang at very base of sandstone cliff in complete shade, 12°29'16.2"S, 132°56'40.1"E, May 1997, *Snow* 7443 et al. (BRI, DNA, K, MO); Northern Kakadu, 12°32'S, 132°39"E, Apr 1983, *King* 226 (DNA); Headwaters of the East Alligator River, Arnhem Land, 12°48'S, 133°21'E, Mar 1984, *Wightman* 1377 & *Craven* (AD, BRI, CANB, DNA, PERTH); East Alligator River, 13°01'S, 133°25'E, Nov 1987, *Dunlop* 7308 (BRI, DNA); ESE Mudginberry, 12°36'S, 132°58'E, Feb 1973, *Dunlop* 3297 (BRI, DNA); East Alligator River, 38 miles SSE of Oenpelli, 12°47'S, 133°21'E, Jul 1972, *Adams* 2866 (BRI, DNA); Magela Creek, Sept 1970, *Byrnes* 1973 (DNA); Nabarlek, 12°30'S, 133°21"E, Feb 1989, *Hinz* 418 (CANB, DNA); 19 km E of Jabiru, 12°37'S, 133°03'E, *Russell-Smith* 8032 & *Lucas* (DNA); 18 km NNE of Jabiru East, 12°30.5S, 132°57'E, Jun 1980, *Craven* 6360 (CANB, DNA); 14.5 km NE of Jabiru East, 12°33.5'S, 132°59'E, May 1980, *Craven* 5967 (CANB, DNA); Kakadu N.P., 7 km NNE of Jabiru, 12°35'52"S, 132°59'27"E, Apr 1995, *Egan* 4782 & *Knox* (DNA); 20 km S of Nabarlek, 12°30'S, 133°21'E, Jul 1989, Hinz 551 (DNA); Upper East Alligator River area, Arnhem Land, 12°39'S, 133°29'E, Feb 1991, *Russell-Smith* 8424 & *Brock* (DNA); 44 km SE Oenpelli, 12°34'S, 133°23'E, Jun 1978, *Dunlop* 4916 (DNA); Arnhem Land, 19 km E of Jabiru, 12°37'S, 133°03'E, Apr 1989, *Johnson* 4514 (BRI).

***Distribution and habitat*:** Northern Territory, Darwin and Gulf Region. Often growing in the semi-shaded overhangs at base of sandstone escarpments; in sandy soils.

***Phenology*:** Flowering February to May; fruiting April to November.

***Notes*:** The species is unmistakable in the genus because of its leaf size. It is prone to mealy bug and ophiostomoid fungal infestations (Snow, pers. obs.).

***Conservation status*:** Given the relatively few collections, subpopulation sizes of usually less than fifteen individuals, and the observed lack of seedling recruitment (Snow and Guymer, pers. obs.), the species is considered vulnerable (criterion D1).

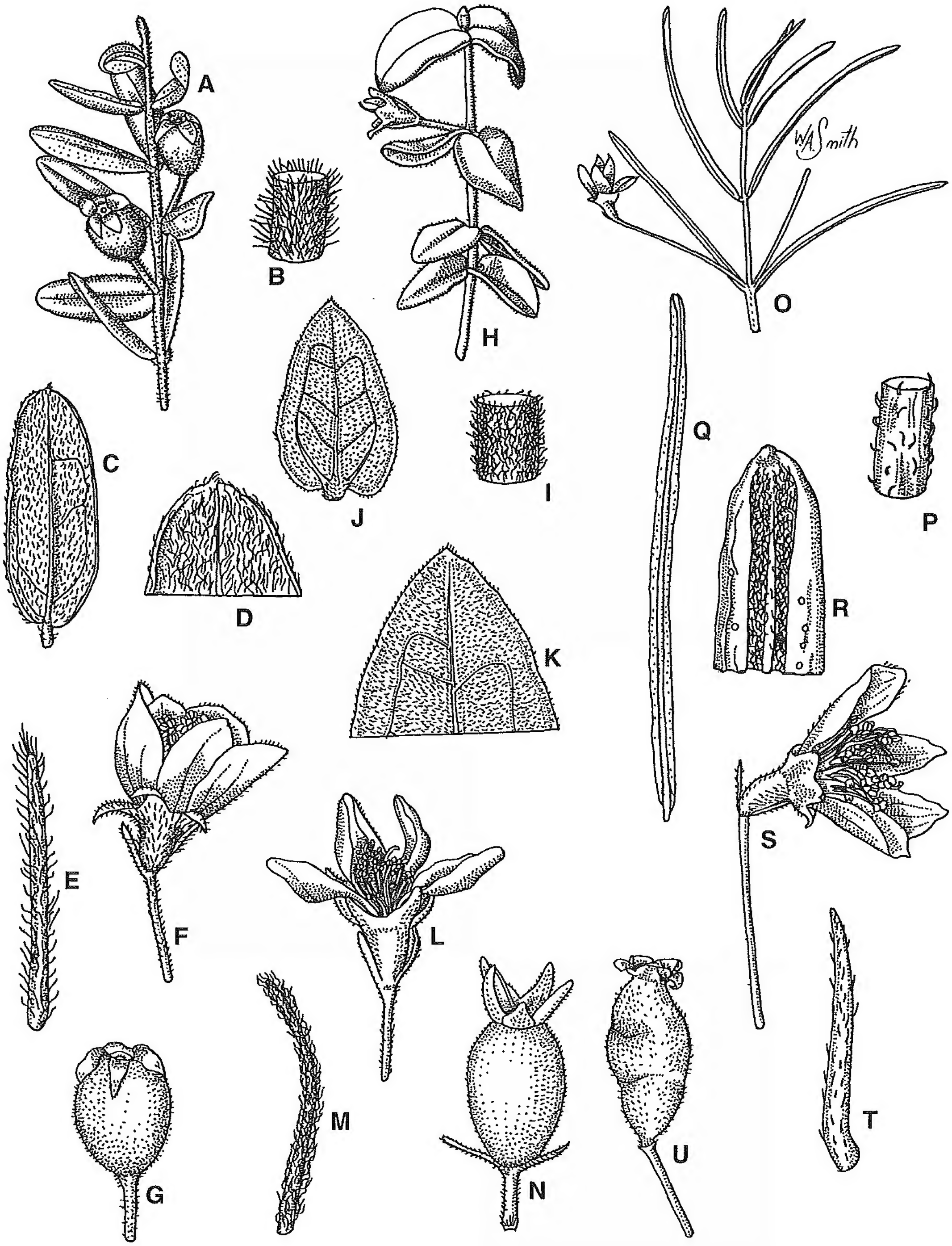

Figure 6. A–G: *Lithomyrtus hypoleuca*. A. fruiting branchlet × 1. B. section of branchlet × 8. C. abaxial leaf profile × 2. D. abaxial leaf apex × 4 E. bracteole × 16 F. flower × 3 G. fruit × 2. A–D, G. *Latz 7335* (DNA). E–F. *Egan* 4861(DNA). **H–N: *L. kakaduensis*.** H. flowering branchlet × 1. I. section of branchlet × 8. J. abaxial leaf profile × 2. K. adaxial leaf apex × 4. L. flower × 2. M. bracteole × 8. N. fruit × 1.5. H–N. *Snow* 7450 *et al.* (BRI) **O–U: *L. linariifolia*.** O. flowering branchlet × 1. P. section of branchlet × 16. Q. abaxial leaf profile × 2. R. abaxial leaf apex × 16. S. flower × 3. T. bracteole × 16. U. fruit × 2. O–T: *Craven* 8248 *& Wightman* (DNA). U: *Cowie* 1109 *& Leach* (BRI).

Etymology: The specific epithet is derived from Latin and refers to the large leaves of the species.

5. Lithomyrtus hypoleuca F.Muell. ex N.Snow & Guymer **sp. nov.** Plantae erectae. Folia plerumque elliptica; pagina inferior foliorum dense hirsuta, glandibus nullis vel raro praesentibus et venis secundariis lateralibus prominentibus carens. Fructus plerumque cylindrici, glabrescentes usque villosi. **Typus:** Australia. Northern Territory. DARWIN AND GULF REGION: McArthur River station, Abner Ranges, 16°44’45’S, 135°57’31”E, 21 May 1997, *C. R . Michell & D. S. Calliss* 869 (holo: DNA; iso: BRI, CANB, K, MEL, MO, NSW).

Shrubs 0.5–1.5 m tall, stems erect or ascending. Bark smooth or stringy, brown, grey or orangish. Branchlets tomentose, oil glands lacking. Leaves opposite, mostly concentrated near branch tips or evenly distributed, soft but becoming coriaceous. Petioles 1–2.5 mm long, channelled (slightly), glandular. Leaf blades narrowly elliptic to ovate, 10–33 mm long, 6–12 mm wide, base truncate or cuneate, apex obtuse, margins revolute, upper surface glabrescent to sparsely short villous, adaxial midvein impressed, lower surface tomentose, glands of lower surface not visible, marginal veins of lower surface invisible or absent. Peduncles rigid, 6.5–19 mm long, sparsely villous to villous. Bracteoles 3–4.7 mm long, 0.4–0.7 mm wide, tips (in flower) not exceeding base of sepal lobes, densely villous, caducous in fruit. Hypanthium densely villous. Sepal lobes 3.2–4 mm long, apex acute or acuminate, villous, persistent or deciduous in fruit, mostly reflexed towards body of fruit. Petals pink, ovate to obovate, 5.5–9 mm long, upper surface glabrous, lower surface villous. Stamens 2.5–6 mm long; anthers connectives eglandular. Style 3–9 mm long, flexuous, sparsely sericeous. Fruit subcylindrical, base rounded, 6–9 mm long, 4.5–7 mm wide, glabrescent to villous, whitish. (Embryos not seen.) Fig. 6A–G.

***Specimens examined*: Northern Territory.** DARWIN AND GULF REGION: 14 km NE of Mann River Gorge, 12°39’S, 134°08’E, Nov 1987, *Leach & Dunlop* 1594 (BRI, DNA); Near Magela Creek, 13.5 km SE of Jabiru East, 12°45’S, 132°59’E, Jun 1980, *Craven* 6337 (CANB); Headwaters E. Alligator River, 12°47’17”S, 133°21’61”E, May 1997, *Guymer* 2501 et al. (BRI, CANB, DNA, K, MO); Mt. Brockman, 12°46’S, 132°54’E, Apr 1980, *Dunlop* 5489 (BRI, CANB); Kakadu N.P., Birdie Creek, 13°57’S, 132°52’E, Apr. 1990, *Cowie* 1110 *& Leach* (BRI); Cox River Station, 16°01’S, 134°46’E, Jul 1977, *Latz* 7335 (DNA); 10 km NNE of Jabiru, Kakadu N.P., 12°34’54”S, 132°59’10”E, Apr 1995, *Egan* 4861 (CANB, DNA); Kakadu N.P., 5 km S of Cahill’s Crossing, East Alligator River, 12°28’S, 132°57’E, Apr 1983, *Thompson* 306 (CANB); 6 km SW of Mt. Brockman, 12°46’S, 132°54’E, Apr 1980, *Telford* 8085 *& Wrigley* (CANB); Beetle Spring, 20 km SE of McArthur River Stn Hmstd, 16°47’S, 135°59’E, Jun 1990, *Menkhorst* 967 (DNA, MEL); Upper East Alligator River, Arnhem Land, 12°49’S, 133°22’E, *Russell-Smith* 5914 *& Lucas* (DNA); 10 miles SSW of Borroloola, Jun 1971, *Dunlop* 2217 (BRI, CANB). **Queensland.** BURKE DISTRICT: Hells Gate, 17°28’S, 138°22’E, May 1974, *Carolin* 9171 (BRI); Hells Gate between Doomadgee and Westmoreland Station, May 1974, *Pullen* 9177 (BRI, CANB); Westmoreland, Big Amphitheatre, 17°24’08”S, 138°15’25”E, May 1997, *Forster* PIF21046 (BRI); Westmoreland Station, 70 km from Wollogorang towards Burktown, 17°20’S, 138°15’E, Jul 1972, *Gittins* 2492 (BRI). COOK DISTRICT: Gilbert River Holding site EU 553, 19°04’54”S, 143°31’32”E, Apr 1994, *Godwin* s.n. (BRI [AQ 630612]).

Distribution and habitat: Northern Territory, Darwin and Gulf Region; Queensland, Burke and Cook Districts. Occurring on rocky slopes and sandstone escarpments in open woodlands.

Notes: *Lithomyrtus hypoleuca* is the most difficult species of this genus to identify because it can resemble several other species. It most resembles *L. densifolia*, but can be distinguished from this species by almost always lacking abaxial leaf oil glands, generally having larger and fewer leaves, and having eglandular anther connectives. Embryo characters were not seen in the nine fruits sampled. The species was not seen in the field.

Phenology: Flowering April to June; fruiting June to November.

Conservation status: Although a recent collection (*Forster* PIF21046) records the species as locally common in the Westmoreland area, the few collections in herbaria suggest the species should be considered vulnerable (criterion D1) pending further information.

Etymology: The specific epithet is from Greek *hypo-*, below or under, and *leuca*, white, a reference to the white underside of the leaves.

6. Lithomyrtus kakaduensis N.Snow & Guymer **sp. nov.** Plantae plerumque erectae. Folia ovata, apetiolata, basibus cordatis ac amplexicaulibus; pagina inferior foliorum dense hirusta, venas secundarias laterales prominentes gerens autem glandibus carens. Fructus subglobosi usque subcylindrici, villosi. **Typus:** Australia: Northern Territory. DARWIN AND GULF DISTRICT: Kakadu National Park, 5.7 km off Kakadu highway along road to Gunlom,13°32'20.3"S, 132°20'06.8"E, 18 May 1997, *N.Snow* 7450 et al. (holo: DNA; iso: BRI, CANB, K, L, MEL, MO, NSW, PERTH, US).

Erect shrubs 0.5–2 m tall. Bark smooth, or stringy, orangish. Branchlets tomentose, oil glands lacking. Leaves opposite, concentrated near branch tips or mostly distributed, soft. Petioles 0.2–0.5(–1) mm long, eglandular. Leaf blades ovate to broadly ovate, 9–34 mm long, 6–22 mm wide, base cordate, clasping the stem, apex obtuse, margins revolute, upper surface sparsely short villous to sparsely tomentose, adaxial midvein impressed, lower surface tomentose, oil glands of lower surface not visible, marginal veins of lower surface prominent. Peduncles rigid, 10–20 mm long, sparsely villous to villous. Bracteoles 4–6 mm long, 0.5–0.8 mm wide, tips (in flower) not exceeding base of sepal lobes, villous, persistent or (usually) caducous in fruit. Hypanthium villous to densely villous. Sepal lobes 3–5 mm long, apex acuminate, villous to tomentose, persistent in fruit, mostly ascending and above body of fruit. Petals pink, obovate, 7–9 mm long, upper surface glabrescent to sparsely sericeous, lower surface sericeous. Stamens 4–6 mm long; anther connectives glandular. Style 5–6 mm long, flexuous or mostly straight, glabrous. Fruit subglobose to subcylindrical, base rounded, 7–14 mm long, 6–9.5 mm wide, villous, yellow-green or olive-green or whitish. Radicle tip somewhat spirally contorted above or below plane of embryo. Fig. 6H–N.

***Specimens examined*:** **Northern Territory.** DARWIN AND GULF REGION: Kakadu N.P., 5.7 km along dirt road to Gunlom from Kakadu Highway, c. 50 m S of road, 13°32'18.5"S, 132°28'12.9"E, May 1997, *Snow* 7448 et al. (BRI, CANB, DNA, K, L, MO, NSW, PERTH); Kakadu N.P., Twin Falls, 13°18'S, 132°51'E, Jul 1983, *Dunlop* 6723 & *Wightman* (BRI, DNA, MEL, PERTH); Without precise locality, 13°44'S, 132°40'E, Jul 1972, *Lazarides* 7684 (BRI, CANB); Kakadu N.P., 8 km NNE of Mt. Evelyn, 13°32'S, 132°56'E, Apr 1989, *Menkhorst* 343 (BRI, DNA, MEL); Headwaters Katherine River, Arnhem Land, 13°46'15"S, 133°09'03"S, Jul 1996, *Mangion* 237 & *Dunlop* (BRI); Gradys Creek, Arnhem Land, 13°29'S, 133°01'E, Jul 1995, *Merrotsy* 2474A (BRI); Gimbat Station, source of South Alligator River, 13°45'S, 132°38'E, Jul 1983, *Russell-Smith* 743 (DNA, MEL); Jim Jim Creek, 3.5 km ESE of Jim Jim Falls, 13°17'S, 132°52'E, May 1980, *Craven* 5819 (CANB, DNA); Kakadu N.P., adjacent to Round Jungle, 13°18'S, 132°38'E, Apr 1987, *Russell-Smith* 2176 & *Lucas* (DNA); 75 km NE of Pine Creek along road to El Sharana, 13°32'S, 132°21'E, May 1983, *Briggs* 925 (BRI, CANB, DNA); Kakadu Hwy at Gunlom turnoff, 13°33'S, 132°17'E, Dec 1995, *Brennan* 3191 (DNA); UDP Falls road, c. 5.5 km E from Kakadu Hwy, 12°32'S, 132°20'E, Apr 1987, *Purdie* 3228 (CANB, DNA); Headwaters of Twin Creek, 13°26'43"S, 133°51'04"E, Apr 1995, *Leach* 4337 & *Greschke* (DNA); 31 km WSW of Twin Falls, 13°20'S, 132°29.5'E, Jun 1980, *Craven* 6404 (CANB, DNA); 6 km ESE of Twin Falls, 13°22S, 132°48'E, May 1980, *Craven* 5845 (CANB); Kakadu N.P., Upper Birdie Creek, 13°53'S, 132°57'E, Apr 1990, *Slee & Craven* 2526 (CANB) & 2527 (AD, CANB, MEL); Kakadu N.P., Kakadu Hwy 1.2 km S of entrance to Mary River Ranger Station, 13°33'S, 132°16'E, Apr 1990, *Slee & Craven* 2959 (CANB, MEL).

***Distribution and habitat*:** Northern Territory, Darwin and Gulf Region. On gentle slopes or sandstone ridges with *Eucalyptus phoenicea* F. Muell., *E. miniata* A. Cunn. ex Schauer, *E. tetrodonta* or *Acacia* spp. in sandy soils.

***Phenology*:** Flowering December to May; fruiting May to December.

***Notes*:** Specimens of *L. kakaduensisi* with oil glands on the abaxial leaf surface may be hybrids of this species with *L. cordata* or *L. retusa* (viz *Hearne* 1740; *Craven* 6404 [CANB 307316]). The second accession of *Craven* 6404 (CANB 307317) is an intergrade of this species with *L. densifolia*, as evidenced by its dense foliage and abundant fruit on short peduncles.

***Conservation status*:** Although occasionally occurring in subpopulations greater than 10 individuals (Snow, pers. obs.), the absence of seedlings and narrow geographic range suggest the species should be considered vulnerable (criterion D1).

***Etymology*:** The epithet is a contraction of `Kakadu' and Latin *-ensis* indicating the occurrence of the species largely within Kakadu National Park.

7. Lithomyrtus linariifolia N.Snow & Guymer **sp. nov.** Plantae plerumque decumbentes. Folia linearia, glandibus subtus carentia. Pedunculi sparse sericei, folia subtenta usque duplo longiores. Fructus fusiformes, glabri usque sparse villosi. **Typus:** Australia, Northern Territory, Upper East Alligator River, Arnhem Land, 12°39'S, 133°23'E, 20 Feb 1991, *J.Russell-Smith* 8435 & *Brock* (holo: DNA).

Plants suffrutescent, rarely shrubby, 0.1–0.2 (–1.0) m tall, stems prostrate or rarely erect. Bark stringy, brown to orangish. Branchlets sparsely sericeous (with antrorse hairs bending sharply at base) or villous, glands lacking. Leaves opposite, mostly evenly distributed, coriaceous. Petioles 0.5–1.3 mm long, rounded, eglandular. Leaf blades linear, mostly 10–51 mm long, 1–3 mm wide, base cuneate, free from the stem, apex acute, margins revolute, upper surface glabrous to sparsely sericeous, adaxial midvein impressed, lower surface somewhat sericeous to densely villous, glands of lower surface not visible (usually), or visible and about the same size (very rarely), marginal veins of lower surface invisible or indistinct. Peduncles flexible, 27–58 mm long, sparsely antrorsely sericeous to sparsely villous. Bracteoles 2–2.5 mm long, c. 1 mm wide, tips (in flower) not exceeding base of sepal lobes, sparsely sericeous to glabrous, mostly caducous in fruit. Hypanthium densely sericeous. Sepal lobes 1.1–2 mm long, sparsely sericeous, persistent in fruit, mostly ascending and above body of fruit. Petals pink, elliptic to ovate, 5–7 mm long, upper surface mostly glabrous, lower surface sericeous to sparsely villous. Stamens 3–3.5 mm long; anther connectives glandular. Style 2.5–3 mm long, flexuous or mostly straight, sparsely sericeous. Fruit fusiform, base tapered, 8.5–11 mm long, 3.5–4 mm wide, sparsely sericeous to sparsely tomentose, glabrescent, yellow-green or olive-green. Embryos not seen. Fig. 6O–U.

***Selected specimens*:** **Northern Territory**. Darwin and Gulf Region: Kakadu N.P., Birdie Creek, 13°57'S, 132°52'E, Apr 1990, *Cowie* 1109 & *Leach* (BRI, DNA, MEL); Head of gorge between Twin Falls and Jim Jim Falls, 13°19'S, 132°59'E, Mar 1984, *Craven* 8248 & *Wightman* (AD, CANB, DNA, MEL); c. 10 km NNE of Jabiru, 12°34'23"S, 132°59'16"E, *Egan* 4849 (CANB, DNA); Kakadu N.P., 10 km NE Jabiru, 12°34'02"S, 132°59'02"E, Apr 1995, *Russell-Smith* 10481 (DNA); 6 km ESE of Twin Falls, 13°22'S, 132°48'E, May 1980, *Craven* 5837 (CANB, DNA); 1 km upstream from Twin Falls, 13°20'S, 132°47'E, Mar 1988, *Fensham* 775 (DNA); 14.5 km NE of Jabiru East, 12°33.5'S, 132°59'E, May 1980, *Craven* 5966 (CANB, DNA).

***Distribution and habitat*:** Northern Territory, Darwin and Gulf Region. In heaths or eucalypt woodlands of sandstone escarpments, in sandy or skeletal soils.

***Phenology*:** Flowering March to April; fruiting known only from April.

***Notes*:** The linear leaves and fusiform fruits are distinctive for the species; the sparsely sericeous midvein on the undersurface of the leaf and the densely sericeous peduncles are also reliable diagnostic characters. The fruits are often irregularly swollen near the midpoint, but this feature can also occur in *L. dunlopii*. Embryo characters have not been seen in the fruits sampled. The species was not seen in the field.

***Conservation status*:** Few populations of this species are known and it is considered vulnerable (criterion D1).

***Etymology*:** The specific epithet is derived from Latin and refers to the linear leaves of the species.

8. Lithomyrtus microphylla (Benth.) N.Snow & Guymer **comb. nov.**

Fenzlia obtusa var. *microphylla* Benth., Fl. Austr. 3: 279 (1866); *Fenzlia microphylla* (Benth.) Domin, Biblioth. Bot. 89: 476 (1928); *Myrtella microphylla* (Benth.) A. J. Scott, Kew Bull. 33: 301 (1978). **Type:** Australia. Queensland: Dividing range between the rivers Thomson and Burdekin, *J. Sutherland* s.n. (holo: K).

Erect or prostrate shrubs 0.3–1.5 m tall. Bark smooth, or stringy, brown, grey or orangish. Branchlets villous to tomentose, oil glands lacking. Leaves opposite or occasionally whorled, mostly evenly distributed, coriaceous. Petioles 0.8–1.6 mm long, rounded, eglandular.

Leaf blades narrowly elliptic to ovate, 8–30(–42) mm long, 1.7–2(–4.2) mm wide, the base truncate or cuneate, free from the stem, apex obtuse to acute, margins revolute or flat, upper surface glabrescent to sparsely tomentose, adaxial midvein impressed, lower surface tomentose, oil glands of lower surface usually not visible, marginal veins of lower surface invisible or indistinct. Peduncles rigid, 3–10 mm long, villous to tomentose. Bracteoles 2.5–3.2 mm long, 0.4–0.6 mm wide, tips (in flower) not exceeding base of sepal lobes, villous to tomentose, persistent or caducous in fruit. Hypanthium densely villous to tomentose. Sepal lobes 1.4–2.4 mm long, apex acute to acuminate, glabrous to villous (above), or villous to tomentose (below), persistent in fruit, mostly appressed towards body of fruit. Petals white to magenta, elliptic to obovate, 4–4.7 mm long, upper surface glabrous to sparsely sericeous, lower surface sparsely villous to villous. Stamens 2.5–4 mm long; anther connectives eglandular or glandular. Style 3–4 mm long, flexuous, sparsely sericeous. Stigma apex terete or occasionally capitate. Fruit subcylindrical, base tapered, 5–8.4 mm long, 2.5–4.5 mm wide, glabrescent to sparsely tomentose, yellow-green or olive-green. Radicle tip not spirally contorted, held at same horizontal plane as embryo. Fig. 7A–G.

***Selected specimens*: Queensland**. Burke District: Burra Range, 2.5 km from the Great Divide Crest along Flinders Hwy towards Torrens Creek, 20°44'S, 145°13'E, May 1991, *Telford* 11451 (CANB); 102 km N of Hughenden, on road to Lynd Junction, Poison Creek, 19°56'S, 144°16'E, May 1990, *Halford* Q248 (AD, BRI, DNA); Torrens Creek, Mar 1933, *White* 8723 (BRI); "Warang" Holding, White Mountains, c. 37 km NNW of Torrens Creek township, 20°29S, 144°48'E, Jul 1988, *Fell* DF1292 & *Swain* (BRI); Cook District: 74 km from the Chillagoe-Wrotham Park road towards Bulimba, 16°58'S, 143°43'E, Jan 1993, *Bean* 5656 & *Forster* (BRI); 87 km along road to Bulimba Station, off Chillagoe to Wrotham Park road, 16°54'S, 143°36'E, Feb 1994, *Forster* PIF14743 (BRI, DNA, MEL); Mopata H-W boundary on SWER Line to Robinhood, 18°49S, 143°48'E, Sep 1994, *Godwin* MG4178C (BRI); Poison Creek, 87 miles N of Hughenden, Sep 1937, *Brass & White* 68 (BRI). Mitchell District: Barcaldine Shire; Busthinia Quarry, c. 43 km E of Barcaldine, 23°34'S, 145°43'E, *Anderson* 3730 (BRI); 17 km E of Torrens Creek, North Queensland, Mitchell District, 20°44'S, 145°11'E, Jul 1975, *Chapman* 1359 (BRI, CANB, PERTH); N side of Flinders Highway, 140 km of Charters Towers, 20°44'S, 145°11'E, *Jobson* 1804 (BRI, MEL,); 41 km NW of Torrens Creek, 20°26'32"S, 144°50'05"E, Apr 1993, *Thompson* HUG413 et al. (BRI); "Fleetwood" Station, Aramac, Aug. 1962, *Cockburn* s.n. (BRI). North Kennedy District: Burra Range, 4 km from Great Divide Crest towards Pentland along Flinders Hwy, 20°41'S, 145°14'E, May 1991, *Telford* 11430 & *Rudd* (CANB); Beside Greenvale-Charters Towers road, 32.3 km from Greenvale, 19°07'S, 145°20'E, Jun 1989, *Bean* 1069, (BRI); 5 km SW of "Milray", 20°43'S, 145°41'E, Nov 1991, *Thompson* 392 and *Robins* (BRI); 7.5 km SSE of Mt. Cooper HS, 20°35S, 146°48'E, Jun 1992, *Thompson* CHA18 & *Sharpe* (BRI); 8 miles W of Pentland, Jun 1953, *Perry* 3553 (BRI, DNA, MEL, PERTH). South Kennedy District: 19.7 km W of Oxenhope outstation, at Charlies Creek crossing, 21°07'S, 145°30'E, May 1991, *Neldner* 3190 & *Thompson* (AD, BRI); c. 21 km NNW of Yarrowmere Station homestead on Great Dividing Range, 21°17'S, 145°48'E, Oct 1983, *Henderson* H2856 et al. (BRI, CANB); c. 22.5 km NNW of Yarrowmere Station homestead on the Great Dividing Range, 21°16'S,145°49'E, Oct 1983, *Henderson* H2846 et al. (BRI, CANB); c. 4 km N of the homestead, on Moonoomoo Station, 21°46S, 145°05'E, Oct 1983, *Henderson* H2776 et al. (BRI); c. 22 km NE of Mirtna Station homestead on S side-road to the Charters Towers to Clermont road, 21°12'S, 146°12'E, Oct 1983, *Henderson* H2903 et al. (BRI).

***Distribution and habitat*:** Queensland: Cook, Burke, North Kennedy, South Kennedy, and Mitchell Pastoral Districts. In open forests, shrublands and heaths, on ridgetops, in sandy or gravelly soils; elevation from 170 to 500 metres.

***Phenology*:** Flowering February to November; fruiting March to November.

***Notes*:** A few specimens of *L. microphylla* with longer than average leaves occasionally have a few oil glands faintly visible on the lower leaf surface. Some specimens (*Bean* 5656; *Forster* PIF14743) have three leaves per node.

***Conservation status*:** Often common to abundant locally.

9. Lithomyrtus obtusa (Endl.) N.Snow & Guymer **comb. nov.**

Fenzlia obtusa Endl., Ataka Bot.: 19, t. 17 (1834); *Myrtella obtusa* (Endl.) A. J. Scott, Kew Bull. 33: 300 (1978). **Type:** Australia: Queensland: Port Curtis Pastoral District: Between Curtis and Facing Islands, *F. L. Bauer* s.n. (holo: W; iso: K [photo BRI]).

Erect shrubs 0.3–2.5 m tall. Bark smooth or stringy, brown or grey. Branchlets tomentose,

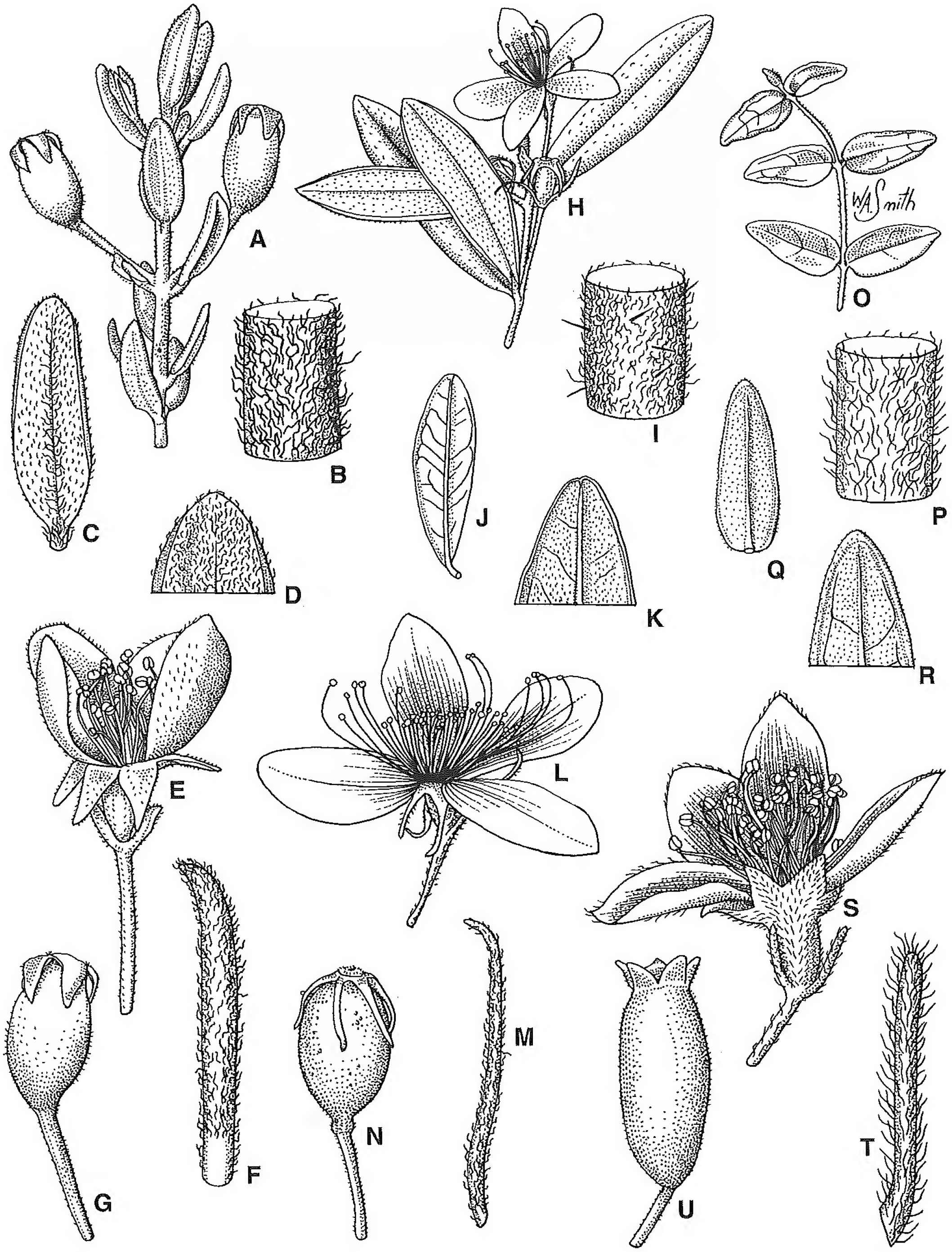

Figure 7. A–G: *Lithomyrtus microphylla*. A. fruiting branchlet × 2. B. section of branchlet × 16. C. adaxial leaf profile × 4. D. adaxial leaf apex × 8. E. flower × 4. F. bracteole × 16. G. fruit × 3. A–D, G: *Forster* PIF16665 (BRI). E–F: *Bean* 5758 (BRI). **H–N: *L. obtusa*.** H. flowering branchlet × 1.5. I. section of branchlet (hairs and fungal bodies) × 16. J. adaxial leaf profile × 1. K. adaxial leaf apex × 2. L. flower × 3. M. bracteole × 8. N. fruit × 3. H–M: *Bailey* s.n. (BRI AQ 040624). N: *White* 10126 (BRI). **O–U: *L. repens*.** O. branchlet × 0.5. P. section of branchlet × 12. Q. adaxial leaf profile × 1. R. adaxial leaf apex × 2. S. flower × 4. T. bracteole × 16. U. fruit × 3. O: *Mangion* 218 (DNA). P–R, U: *Snow* 7425 *et al.*(BRI). S, T: *Dunlop & Byrnes* 2109 (DNA).

oil glands lacking. Leaves opposite, concentrated near branch tips or evenly distributed, coriaceous. Petioles 1–3 mm long, channelled, eglandular. Leaf blades narrowly elliptic to ovate, or obovate, 15–42 mm long, (4–)7–13 mm wide, base cuneate, free from the stem, apex obtuse or retuse, margins revolute or flat, upper surface glabrous, glabrescent or sparsely short-villous, adaxial midvein impressed, lower surface tomentose, oil glands of lower surface not visible, marginal veins of lower surface mostly invisible or indistinct. Peduncles rigid, 3–8 mm long in flower, 5–14 mm long in fruit, villous to tomentose. Bracteoles 4–9 mm long, 0.4–0.6 mm wide, tips (in flower) exceeding base of sepal lobes, sometimes considerably so, villous to densely villous, caducous in fruit. Hypanthium tomentose. Sepal lobes 2.5–4 mm long, apex acuminate, glabrous (above) or tomentose (below), persistent in fruit, mostly reflexed towards body of fruit. Petals pink, ovate to obovate, 6–9 mm long, upper surface glabrescent, lower surface glabrous to sparsely villous. Stamens 4–7 mm long; anther connectives glandular. Style 5–6 mm long, mostly straight, sparsely sericeous. Fruit globose to subcylindrical, sometimes slightly tapered above, base slightly tapered, 5–9 mm long, 3.5–5 mm wide, glabrescent to sparsely villous, yellow-green or olive-green to dark bluish-black (rarely reddish). Radicle tip not spirally contorted above or below horizontal plane of embryo. Fig. 7H–N.

***Selected specimens*: Queensland.** Cook District: Endeavor River, near Marton, 15°28’S, 145°11’E, May 1991, *Dunlop* 7932 & *Clarkson* (BRI, CANB, DNA); E of Escape River, Old Comalco campsite near lake, W of Sadd Point, c. 11°03’S, 142°45’E, Aug 1978, *Kanis* 2073 (BRI, CANB); Between Half Moon Creek and Earl Hill near Cairns, 16°48’S, 145°42’E, Oct 1979, *Batianoff* 1306 & *McDonald* (BRI); Mt. Saunders, near Cooktown, 15°25’S, 145°14’E, Mar 1984, *Scarth-Johnson* 1439A (BRI); Wangetti Beach, Cook Hwy, 16°40’S, 145°34”E, Sep 1992, *Gray* 5556 (QRS); Fitzroy Island, near Cairns, 16°56’S, 146°00’E, May 1968, *Berry* 14942 (QRS); Road to Cape Flattery, c. 0.5 km W of beach, 15°07’S, 145°13’E, Jun 1992, *LeCussan* 98 (QRS); 5 miles N of crossing on Massey Creek on road between Silver Plains Station and Rocky River, c. 13°50’S, 143°29’E, Oct 1969, *Webb & Tracey* 9732 (BRI); Cape York, 100 metres from the tip, 10°40’S, 142°35’E, Aug 1986, *Archer* s.n. (DNA); Headland between Narau and Nanthau beaches, Newcastle Bay, 10°47’S, 142°35’E, Feb 1990, *Forster* PIF6359 (BRI, DNA); Mt. Tozer summit area, Iron Range N.P., 12°45’S, 143°12’E, Jul 1994, *Forster* PIF15428 (BRI); Coastal Cliffs above Captain Billy Beach, 11°38’S, 142°51’E, May 1980, *Morton* 636 (BRI, MEL); 8.5 km N of the Lockhart River Road on the track to Wattle Hill, 12°41’S, 143°05’S, Aug 1991, *Clarkson* 9077 & *Neldner* (BRI, DNA); 3.8 km E of Garraway Creek on road to Portland Roads, 12°44’S, 143°12’E, Jul 1991, *Neldner* 3533 & *Clarkson* (BRI, DNA); Finch Bay, Mar 1966, *Smith* 13102 (BRI, CANB); Cooktown, mouth of Endeavour River, north bank, 15°28’S, 145°15’E, May 1970, *Blake* 23297 (MEL, PERTH); Moa Island, Torres Strait, 10°11’S, 142°16’E, May 1953, *Marks & Mackerras* s.n. (BRI); 15.1 km S of beachfront at Bathurst Bay on track to “Wakooka”, Jul 1984, *Puttock & King* UNSW16751 (BRI, MEL); Cairns, semi-shade on edge of swamp, Apr 1967, *Brass* 33539 (BRI); 2.5 km N of the mouth of the McIvor River, 15°07’S, 145°14’E, Feb 1984, *Clarkson* 5163 (BRI, MEL); Sharp Point, 10°57’S, 142°43’E, Jun 1978, *Clarkson* 2104 (BRI); North Kennedy District: Forrest Beach, c. 12 miles E of Ingham, May 1970, *Fagg* 721 (AD, CANB); Hinchinbrook Island, N end of Ramsay Bay, 18°46’S, 146°18’E, Jul 1988, *Thompson* 915 (CANB); South Kennedy District: Shaw Island, 20°29’S, 149°09’E, Nov 1985, *Batianoff* 3212 & *Dalliston* (BRI, CANB). Port Curtis District: Clinton Lowland, Shoalwater Bay area, 22°35’S, 150°42’E, Feb 1992, *Thompson* 73 (BRI); Upper reaches of Leeks Creek, Great Keppel Island, 23°10’S, 150°57’E, Nov 1987, *Batianoff* 9467 & *Dillewaard* (BRI); Port 1, between Curtis and Facing Islands, Aug 1802, *R. Brown* “no. 14 spec.” (BRI); South Percy Island, NW of Onslow Point, 21°45’E, 150°20’E, Oct 1989, *Batianoff* 11470 et al. (BRI); Nine Mile Beach, 2–2.5 km NW of Waterpark Point, 22°55’S, 150°47’E, Jul 1977, *Batianoff* 485 & *McDonald* (BRI); Middle Percy Island, 87 miles SE of Mackay, Apr 1956, *Lazarides* 5625 (AD, BRI, DNA, MEL, PERTH); Port Curtis (Port 1), between Curtis and Facing Island, Aug 1802, *R. Brown* s.n. (CANB); “Green Horizons” property of A. Geckeler, 8.4 km from Rules Beach Rd along Fingerfield Rd, c. 60 km direct line NW of Bundaberg, 24°26’S, 151°59’E, Oct 1992, *Geckeler* et al. 9 (CANB).

***Distribution and habitat*:** Queensland: Cook, North Kennedy, Port Curtis, and South Kennedy Pastoral Disticts. In heaths, woodlands, shrublands, open forests and vineforest, in sandy soils; altitude from sea level to c. 120 metres.

***Phenology*:** Flowering January to September; fruiting throughout the year.

***Notes*:** The leaves and fruits of this species are sometimes reported to be reddish. A few specimens have oil glands slightly visible on the petioles and abaxial leaf surface (*Marks & Mackerras* s.n., BRI; *Pedley* 2730, BRI; *Forster* PIF5337, DNA). Possible hybrids with *L. retusa* include *Pedley* 2730 and *Gray* 6126 (QRS). The black hair-like structures often visible on the leaves and stems represent an ophiostomoid fungal infection (J. Simpson, pers. comm., the longer, straight projections in Fig. 7i).

Details from Scott (1978) regarding the type appear to be correct, except for our replacement of "east coast" with more detailed locality information (Burbidge, 1955; see also Burbidge manuscript "An index to the microfilm of Robert Brown's botanical descriptions (manuscript) of Australian plants held at the British Museum (Natural History) at the British Museum" [copies at BRI, CANB]).

Conservation status: Common throughout much of its range.

Local name: "aringi" (*Brass* 18650, BRI).

10. Lithomyrtus repens N.Snow & Guymer **sp. nov.** Plantae procumbentes. Folia anguste ovata usque ovata, basi truncata vel cordata, non amplexicaulia; pagina inferior foliorum dense hirsuta, glandibus nullis autem venis secundariis lateralibus saepe praesentibus. Pedunculi folia plerumque longiores. Fructus subcylindrici usque cylindrici, glabrescentes usque sparse villosi. **Type:** Australia. Northern Territory. DARWIN AND GULF REGION: Arnhem Land, Upper Catchment of East Alligator River, 12°47'31.3'S, 133°21'51.8"E, 12 May 1997, *N.Snow* 7425 et al. (holo: DNA; iso: BRI, CANB, K, L, MEL, MO, NSW, US).

Plants suffrutescent, 0.2–0.4 m tall, stems prostrate. Bark stringy, orangish. Branchlets villous to tomentose, oil glands lacking. Leaves opposite, mostly evenly distributed, coriaceous. Petioles 1.3–1.7 mm long, rounded or channelled, eglandular. Leaf blades narrowly ovate to ovate, 14–45 mm long, 7–13(–22) mm wide, base truncate or cordate, free from or occasionally clasping the stem, apex obtuse or acute, margins revolute or flat, upper surface glabrous, glabrescent or sparsely short villous, adaxial midvein impressed, lower surface tomentose, oil glands of lower surface visible, marginal veins of lower surface prominent, or invisible or indistinct. Peduncles rigid or flexible, 10–55 mm long, sparsely villous to villous. Bracteoles 1.8–3.1 mm long, 0.2–0.5 mm wide, tips (in flower) not exceeding base of sepal lobes, villous, persistent or caducous in fruit. Hypanthium densely villous to tomentose. Sepal lobes 1–2 mm long, apex acute, villous to tomentose, persistent in fruit, mostly reflexed towards body of fruit. Petals pink to magenta, elliptic to obovate, 5–7 mm long, upper surface glabrous, lower surface villous. Stamens 3.5–5 mm long anther connectives eglandular. Style 4–5.5 mm long, mostly straight, glabrous. Fruit subcylindrical to cylindrical, base tapered, 7.5–10 mm long, 4–5 mm wide, glabrescent to sparsely villous, or villous, yellow-green or olive-green. Radicle tip somewhat spirally contorted above or below plane of embryo. Fig. 7O–U.

Selected specimens: **Northern Territory**. DARWIN AND GULF REGION: East Alligator River, 12°40'S, 133°15'E, Mar 1973, *Dunlop* 3409 (MEL); Arnhem Land, Upper East Alligator River catchment, 12°49'40.1"S; 133°21'47.2"E, May 1997, *Snow* 7427–a (BRI, DNA, CANB); Headwaters E Alligator River, 12°47'17"S, 133°21'61"E, May 1997, *Guymer* 2504 et al. (BRI, DNA, L, MO, NSW); Arnhem Land, Magela Creek upper catchment, 12°49'19"S, 133°00'25"E, Apr 1995, *Cowie* 5606 & *Brennan* (DNA); Kakadu N.P., Upper Koolpin Creek, 13°27'S, 132°39'E, Jun 1988, *Russell-Smith* 5496 & *Lucas* (BRI, DNA); Kakadu N.P., 8 km NNE of Mt. Evelyn, 13°32'S, 132°56'E, *Menkhorst* 341 (DNA, MEL); 13 km SSW of Twin Falls, 13°25.5'S, 132°44'E, May 1980, *Craven* 5897 (DNA); Near Mt. Gilruth, 13°10'S, 133°06'E, Mar 1984, *Craven & Wightman* 8290 (CANB, MEL); Kakadu N.P., Deaf Adder Creek Gorge, 13°07'S, 132°56'E, Apr 1980, *Telford* 7994 & *Wrigley* (CANB);13 km SSW of Twin Falls, 13°25.5'S, 132°44'E, May 1980, Craven 5897 (CANB); 41 miles NE of Pine Creek, Mar 1971, *Dunlop & Byrnes* 2109 (DNA); Above U.D.P. Falls, May 1975, *Gittins* 2863 (BRI, DNA*);* Katherine Gorge N.P., May 1968, *Byrnes* 870 (BRI, DNA, MEL, PERTH); Kakadu N.P., c. 25 km NE of Jabiru, 12°30'24.9"S, 132°57'0.5.5"E, May 1997, *Snow* 7435 et al. (BRI, DNA); Magela Creek, 12°40'S, 133°03'E, Feb 1973, *Dunlop* 3377 (DNA); Upper Magela Creek Valley, Arnhem Land, 12°45'S, 133°05'E, May 1991, *Russell-Smith* 8470 & *Brock* (DNA); Kakadu N.P., Mt. Brockman area, 12°48'S, 132°54'E, Mar 1995, *Russell-Smith* 10221 (DNA); Kakadu Nat. Park, Dinner Creek, 13°38'18"S, 132°36'18"E, Apr 1995, *Leach* 4396 & *Greschke* (DNA); Headwaters Katherine River, 13°46'06"S, 133°09'03"E, Jul 1996, *Mangion* 218 (DNA); Upper East Alligator, Arnhem Escarpment, 12°46'45"S, 133°22'04"E, Jun 1996, *Michell* 299 & *Knox* (DNA); Kakadu N.P., 10.5 km NE of Mt. Evelyn, 13°31'S, 132°57'E, Apr 1990, *Slee & Craven* 2592 (CANB, MEL).

Distribution and habitat: Northern Territory, Darwin and Gulf Region. Amongst rocks on sandstone escarpments in open heaths; soils sandy or skeletal.

Phenology: Flowering February to May; fruiting March to June.

Notes: *Lithomyrtus repens* can resemble *L. hypoleuca* in overall morphology (e.g., *Slee & Craven* 2592), but its prostrate habit and more sparsely pubescent and usually longer peduncles distinguish it from the latter.

Conservation status: The relatively small geographical range and small size of subpopulations (Snow, pers. obs.) suggest *L. repens* is a vulnerable species (criterion D1).

Etymology: The specific epithet is from Latin *repens*, creeping or prostrate, a reference to the habit of the species.

11. Lithomyrtus retusa (Endl.) N.Snow & Guymer **comb. nov.**

Fenzlia retusa Endl., Ataka Bot. 20, t. 18(1834); *Myrtella retusa* (Endl.) A. J. Scott, Kew Bull. 33: 300 (1978). **Type**: Australia, *F. L. Bauer* (lecto: here designated, W, illustration) (fide also Scott 1978).

Fenzlia phebalioides W. Fitzg., J. & Proc. Roy. Soc. Western Australia 3: 189 (1918); *Myrtella phebalioides* (W. Fitzg.) A.J. Scott, Kew Bull. 33: 301 (1978). **Type**: Australia. Western Australia: Tabletop Mountain, Synnot Range, Aug 1905, *W.V. Fitzgerald* 1350 (holo: PERTH).

Shrubs or rarely small trees, 1–3(–5) m tall. Bark smooth or stringy, brown or grey. Branchlets tomentose, oil glands visible and prominent. Leaves opposite, concentrated near branch tips or evenly distributed, coriaceous. Petioles 2–3 mm long, channelled, glandular. Leaf blades narrowly elliptic to elliptic, or obovate (narrowly so), 10–41 mm long, 1–9 mm wide, base cuneate, free from the stem, apex obtuse retuse or rarely acute, margins revolute or flat, upper surface sparsely short- villous to glabrescent, adaxial midvein impressed, lower surface densely tomentose, oil glands of lower surface visible and of differing sizes, marginal veins of lower surface invisible or indistinct. Peduncles rigid, 4–7 mm long, sparsely villous to tomentose. Bracteoles (0.5–)1–2(–3) mm long, 0.2–0.5 mm wide, ascending but not flexuous, the tips (in flower) not exceeding base of sepal lobes, villous to tomentose, caducous in fruit. Hypanthium tomentose. Sepal lobes 1–1.5 mm long, apex acute, glabrous to sparsely villous, persistent in fruit, mostly reflexed towards body of fruit. Petals pink, elliptic to obovate, 3–6 mm long, upper surface glabrous to glabrescent, lower surface sericeous to sparsely villous. Stamens 3–4 mm long; anther connectives glandular with usually 2 or more oil glands. Style 4–5 mm long, flexuous, sparsely sericeous. Fruit globose or subglobose, base rounded, 3–6 mm long, 4–4.5 mm wide, glabrous to sparsely villous, yellow-green or olive-green to dark bluish-black. Radicle tip somewhat spirally contorted above or below plane of embryo. Fig. 8A–G.

Selected specimens: **Western Australia.** 54.5 km N of Broome on Pt Columbo track, Dampier Peninsula, SW Kimberley, 17°36'S, 122°11'E, Jun 1981, *Kenneally* 7584 (BRI, MEL); Forest Creek, near Drysdale River, 14°39'S, 126°57'E, Aug 1975, *George* 14114 (CANB, PERTH); King Edward River, c. 50 km NE of Mitchell River H.S., Aug 1978, *Beauglehole* 59127 & *Errey* 2853 (CANB, PERTH). **Northern Territory.** DARWIN AND GULF REGION: c. 6 miles N of Pine Creek Township, 13°48'S, 131°50'E, Mar 1965, *Lazarides & Adams* 148 (DNA, MEL); Arnhem Land, near Murganella Settlement, west of Workshop Road, 11°32'48.3"S, 132°55'25.3"E, May 1997, *Snow* 7413 & *Mangion* (BRI, CANB, DNA, K, L, MO, NSW); Near Raft Point, 20 km from Mandorah Road, 12°38'S, 130°34'E, Feb 1991, *Cowie* 1491 & *Dunlop* (BRI, CANB, DNA, MEL, PERTH); Gulf of Carpenteria, Maria Island, 14°54'S, 135°41'S, Jul 1972, *Dunlop* 2946 (BRI, DNA, MEL); Wigram Island, 11°45'S, 136°37'E, Jul 1992, *Leach* 3058 (BRI, CANB, DNA); Darwin River, near bridge, 12°42'S, 130°54'E, Feb 1977, *Parker* 705 (CANB, DNA); Headwaters of Waterfall Creek, 13°24'44"S, 132°29'23"E, Apr 1995, *Leach* 4387 & *Greshke* (CANB, DNA); Katherine Gorge N.P., 14°14'S, 132°29'E, Jun 1982, *Siversten* 667 (DNA); Goyder River, 13°01'S, 134°59'E, *Dunlop* 8687 & *White* (CANB, DNA, MEL); Bathurst Island, 8 km E of Nguiu, 11°48'S, 130°30'E, Apr 1987, *Wightman* 3550 & *Smith* (CANB, DNA); Astell Island, N end, 11°51'52"S, 136°24'31"E, Apr 1996, *Cowie* 6585 (DNA); Groote Eylandt, headwaters of Amakula River, 14°06'S, 136°33'E, Sep 1991, *Cowie* 2036 & *Brocklehurst* (CANB, DNA, MEL); Black Islet, Sir Edward Pellew Group, 15°36'S, 136°40'E, Jul 1988, *Thomson* 2573 (DNA); Melville Island, 11°42'S, 130°50'E, Jan 1992, *Leach* 2955 & *Cowie* (CANB, DNA, MEL); Near Doyndgji, E Arnhem Land, 12°55'00"S, 135°24'00"E, Oct 1976, *Scarlett* 45 (DNA). **Queensland.** COOK DISTRICT: Iron Range Road, c. 2 km upstream [from] creek crossing Cape Weymouth, 12°46'S, 143°07'E, Apr 1988, *Forster* PIF4177 & *Liddle* (BRI, CANB); Agate Creek, Robinhood Station, SW of Forsayth, 18°50'S, 143°25'E, Apr 1996, *Forster* PIF19080 et al. (BRI); Moa Island, 10°11'S, 142°16'E, *Budworth* 319 (BRI); McDonald Creek area, 42 km from Mt Surprise township, Mt Surprise gemfields, 18°03'S, 144°07'E, Apr 1985, *Champion* 132 (BRI); 19.8 km from Oroners on the track to New Dixie, 15°21'S, 143°09'E, Jun 1981, *Clarkson* 3762 (BRI); c. 24 km SSE of the mouth of the Olive River, c. 3 km S of Mosquito Point, 12°22'S, 143°10'E, Apr 1993, *Clarkson* 9997 & *Neldner* (BRI); 74 km from the Chillagoe – "Wrotham Park" road towards "Bulimba", 16°58'S, 143°44'E, Jan 1993, *Bean* 5658 & *Forster* (BRI, DNA); 20 km NW of Mount Garnet, on road to Lappa, 17°36'S, 144°59'E, Jan 1993, *Bean* 5488 & *Forster* (BRI); 5 km N of Fairlight on the Palmerville road, 15°42'S, 144°03'E, Jun 1992, *Clarkson* 9610 & *Neldner* (BRI).

***Distribution and habitat*:** Western Australia; Northern Territory, Darwin and Gulf Region; Queensland, Cook District. In *Eucalyptus* woodlands; on sandstone escarpments, occasionally along streambanks, in sandy and skeletal soils.

***Phenology*:** Flowering December to June; fruiting December to September.

***Notes*:** *Lithomyrtus retusa* has the most variation in leaf characters of all species of *Lithomyrtus*. Plants are covered with oil glands nearly throughout, including the upper leaf surfaces where the glands are sometimes dark and prominent. The foliage hairs can appear ferruginous on close inspection (*Snow* et al. 7413; *Bean* 5665 & *Forster*, BRI). A few specimens have the bracteoles exceeding the base of the sepal lobes in length (*Bean* 5658 & *Forster*, BRI; *Bean* 5665 & *Forster*, BRI).

***Conservation*:** Widespread and locally common.

Acknowledgments

Our thanks to the curators of AD, CANB, DNA, FI, K, L, MEL, PERTH, and QRS for loans of and permission to view specimens; the curators of B, BM, C, E, H, K, MO, NY, WRSL for checking for specimens of Volkens; Dr Greg Leach for assistance in planning a field trip to the Northern Territory; Chris Mangion for considerable assistance during fieldwork; Dr Don Foreman when Australian Botanical Liaison Officer, Kew, England, for information

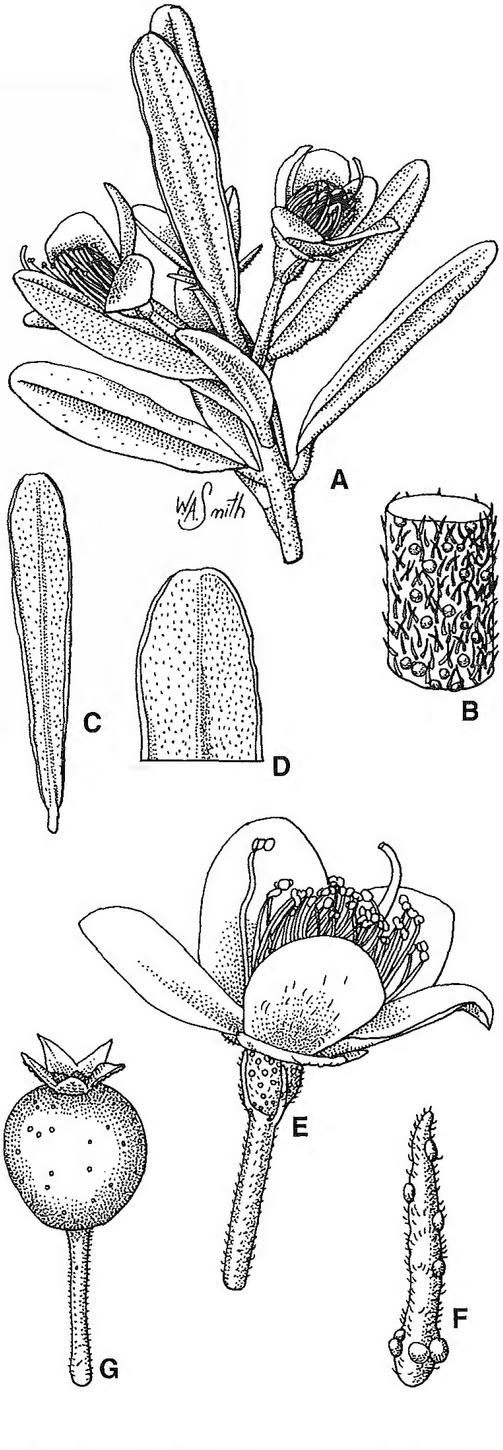

Figure 8. A–G: *Lithomyrtus retusa*. A. flowering branchlet × 3. B. section of branchlet × 2. C. adaxial leaf profile × 2. D. adaxial leaf apex × 4. E. flower × 6. F. bracteole × 24. G. fruit × 4. A–G: *Snow* 7413 & *Mangion* (BRI).

on type material in London; Drs Penny Gullan and John Lawrence for identification of insects; Will Smith for illustrations; Peter Bostock for the Latin descriptions; the Northern Land Council for permission to collect in the Wauk (Murganella) region; and Philip Sharpe for several translations from German. This research was supported by grants from the Australian Biological Resources Study during 1997–1999.

References

Bean, A.R. (1997a). Reinstatement of the genus *Babingtonia* Lindl. (Myrtaceae, Leptospermoideae). *Austrobaileya* 4: 627–645.

—— (1997b). A revision of *Micromyrtus* Benth. (Myrtaceae) in Queensland. *Austrobaileya* 4: 455–476.

—— & M.I.H. Brooker (1995). Four new species of ironbark (*Eucalyptus* L'Hérit., Myrtaceae) from southern Queensland. *Austrobaileya* 4: 187–194.

Beardsall, D.V., O'Brien, S.P., Williams, E.G., Knox, R.B. & Calder, D.M. (1993). Reproductive biology of Australian Myrtaceae. *Australian Journal of Botany* 41: 511–526.

Bentham, G. (1866). *Flora Australiensis* 3: 278–279. London: Lovell Reeve & Co.

—— & J.D. Hooker (1867). *Genera Plantarum* 1: 715. London: Lovell Reeve & Co.

Briggs, B.G. & L.A.S. Johnson (1979). Evolution in the Myrtaceae – evidence from inflorescence structure. *Proceedings of Linnean Society of New South Wales*, Ser. 2, 102: 157–256.

Burbidge, N.T. (1955). Robert Brown's Australian collecting localities. *Proceedings of the Linnean Society of New South Wales* 80: 229–233.

Burret, M. (1941). Myrtaceen-Studien. *Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem* 15: 479–550.

Byrne, M., M.I. Marquez-Garcia, T. Uren, D.S. Smith & G.F. Moran (1996). Conservation and genetic diversity of microsatellite loci in the genus *Eucalyptus*. *Australian Journal of Botany* 44: 331–341.

Chappill, J.A. & P.Y. Ladiges (1996). Phylogenetic analysis of *Eucalyptus* informal subgenus *Symphomyrtus* section *Maidenaria*. *Australian Systematic Botany* 9: 71–93.

Costa, C.G., R.D. Machado & J.B. Fontanelle (1995). Sistema vascular em folhas de *Eugenia* L. (Myrtaceae). *Bradea* 6: 345–356.

Cronquist, A. (1981). *An Integrated System of Classification of Flowering Plants*. New York: Columbia University Press.

Dahlgren, R. & R.F. Thorne (1985). The order Myrtales: circumscription, variation, and relationships. *Annals of the Missouri Botanical Garden* 71: 633–699.

Davis, J.I. (1993). Character removal as a means of assessing stability of clades. *Cladistics* 9: 201–210.

Dallwitz, M.J., T.A. Paine & E.J. Zurcher (1993). *User's Guide to the DELTA system: a general system for processing taxonomic descriptions*. Edition 4. Canberra: CSIRO Division of Entomology.

Diels, L. (1921). Die Myrtaceen Mikronesiens. *Engler Botanische Jahrbücher* 56: 529–534.

—— (1922). Die Myrtaceen von Papuasien. *Engler Botanische Jahrbücher* 57: 356–426.

Endlicher, S. L. 1834. *Atakta Botanica*: 19–21.

Esau, K. (1960). *Anatomy of Seed Plants*. New York: John Wiley & Sons, Inc.

Fitzgerald, W.V. (1918). The botany of the Kimberlys, North-west Australia. *Journal of the Proceedings of the Royal Society of Western Australia* 3: 102–224.

Gadek, P.A., P.G. Wilson & C.J. Quinn (1996). Phylogenetic reconstruction in Myrtaceae using *mat*K, with particular reference to the position of *Psiloxylon* and *Heteropyxis*. *Australian Systematic Botany* 9: 283–290.

Grifo, F.T. (1992). A revision of *Myrcianthes* Berg (Myrtaceae). Ph.D. dissertation. Cornell University, Ithaca. [Unpublished, available from UMI microfilms, Ann Arbor, Michigan, U.S.A.]

Grueter, W., F.R. Barrie, H.M. Burdet, W.G. Chaloner, V. Demoulin, D.L. Hawksworth, P.M. Jørgensen, D.H. Nicolson, P.C. Silva & P. Trehane (1994). *International Code of Botanical Nomenclature (Tokyo Code)*. Regnum Vegetabile 131. Königstein: Koeltz Scientific Books.

Haron, N. W., & D. W. Moore (1996). The taxonomic significance of leaf micromorphology in the genus *Eugenia* L. (Myrtaceae). *Botanical Journal of the Linnean Society* 120: 265–277.

Hendy, M. D., & D. Penny (1982). Branch and bound algorithms to determine minimal evolutionary trees. *Mathematical Bioscience* 59: 277–290.

Hiepko, P. (1987). The collections of the botanical museum Berlin-Dahlem (B) and their history. *Englera* 7: 219–252.

Hill, K.D., & L.A.S. Johnson (1995). Systematic studies in the eucalypts 7. A revision of the bloodwoods, genus *Corymbia* (Myrtaceae). *Telopea* 6: 185–504.

Hubbard, R.J. (1978). *Myrtella*: A generic name change. *Australian Plants* 10: 21.

Huelsenbeck, J.P. (1991). Tree-length distribution skewness: An indicator of phylogenetic information. *Systematic Zoology* 40: 257–270.

Johnson, L.A.S., & B.G. Briggs. (1985) (1984). Myrtales and Myrtaceae – a phylogenetic analysis. *Annals of the Missouri Botanical Garden* 71: 700–756.

Krauss, S.L. (1994). Variation in *Leptospermum trinervium* (Myrtaceae): a problem species and the species problem. *Australian Systematic Botany* 7: 251–263.

Ladiges, P.Y., & C.J. Humphries (1983). A cladistic study of *Arillastrum, Angophora* and *Eucalyptus* (Myrtaceae). *Botanical Journal of the Linnean Society* 87: 105–134.

Landrum, L.R.(1981). A monograph of the genus *Myrceugenia* (Myrtaceae). *Flora Neotropica Monograph Number 29.*

—— (1988). Systematics of *Myrteola* (Myrtaceae). *Systematic Botany* 13: 120–132.

—— & D. Stevenson (1986). Variability of embryos in subtribe Myrtinae (Myrtaceae). *Systematic Botany* 11: 155–162.

—— & J. Bonilla (1996). Anther glandularity in the American Nyrtinae (Myrtaceae). *Madroño* 43: 58–68.

Lyne, A.M., & M.D. Crisp (1996). *Leptospermum jingera* (Myrtaceae: Leptospermoideae): a new species from northeastern Victoria. *Australian Systematic Botany* 9: 301–306.

Mabberley, D.J. (1997). *The Plant-Book: A Portable Dictionary of Higher Plants.* Second Edition. Cambridge: Cambridge University Press.

Merrill, E.D. (1914). An enumeration of the plants of Guam. *Philippine Journal of Science* 9: 11–155.

Mueller, F. (1857). Notes made during the recent expedition across the northern portion of Australia, under the command of Mr. Surveyor Gregory. *Hooker's Journal of Botany and Kew Garden Miscellany* 9: 193–199.

—— (1858). Botanical report on the North-Australian expedition under the command of A. C. Gregory, Esq. J. *Proceedings of the Linnean Society Botany*. 2: 137–163.

—— (1877). *Descriptive notes of Papuan Plants.* Melbourne: George Skinner.

—— (1882). *Census of the genera of plants hitherto known as indigenous to Australia.* Sydney: Government Printer.

Muir, T.B. (1978). An index to the new taxa, new combinations and new names published by Ferdinand J. H. Mueller. *Muelleria* 4: 123–168.

Naylor, G. & A. Krauss (1995). The relationship between s and m and the retention index. *Systematic Biology* 44: 559–562.

Nic Lughadha, E. & C. Proença (1996). A survey of the reproductive biology of the Myrtoideae (Myrtaceae). *Annals of the Missouri Botanical Garden* 83: 480–503.

Niedenzu, F. (1893). Myrtaceae, *In*: Engler & Prantl, *Die Naturlichen Pflanzenfamilien,* Ser. 3, 7: 57–105.

Orlovich, D.A., A.N. Drinnan & P.Y. Ladiges (1996). Floral development in the Metrosideros group (Myrtaceae) with special emphasis on the androceium. *Telopea* 6: 689–719.

Patterson, C. (1982). Morphological characters and homology. Pp. 21–74 *In*: K. A. Josey & A. E. Friday (editors), *Systematics Association Special Volume No. 21, Problems in Phylogenetic Reconstruction.* London: Academic Press.

Sale, M.M., B.M. Potts, A.K. West, & J.B. Reid (1996). Molecular differentiation within and between *Eucalyptus risdonii, E. amygalina* and their hybrids using RAPD markers. *Australian Journal of Botany* 44: 559–569.

Scotland, R.W. (1992). Character coding. Pp. 14–21, *In: Cladistics: A Practical Course in Systematics*, P. L. Forey *et al.* (eds.). The Systematics Association Publication No. 10. Oxford: Clarendon Press.

Scott, A.J. (1978). A new species of *Myrtella* (Myrtaceae) from Australia and a synopsis of the genus. *Kew Bulletin* 33(2): 299–302.

—— (1990). A new combination in *Kania* (Myrtaceae) from West New Guinea. *Kew Bulletin* 45(1): 205–206.

Shapcott, A. & J. Playford (1996). Comparison of genetic variability in remnant and wide-spread rainforest understory species of *Austromyrtus* (Myrtaceae). *Biodiversity and Conservation* 5: 881–895.

Snow, N. (1997). Application of the phylogenetic species concept: A botanical monographic perspective. *Austrobaileya* 5: 1–8.

Sobral, M. (1994). Duas especies e seis combinaçoes novas em *Plinia* (Myrtaceae). *Hoehnea* 21: 199–205.

Species Survival Commission (1994). *IUCN Red List Categories.* Gland: IUCN Council.

Swofford, D.L. (1993). *PAUP: Phylogenetic Analysis Using Parsimony*. Version 3.1.1. Washington, D.C.: Smithsonian Institution.

Takhtajan, A. (1986). *Floristic Regions of the World*. Berkeley: University of California Press.

Thiele, K. & P.Y. Ladiges (1988). A cladistic analysis of *Angophora* Cav. (Myrtaceae). *Cladistics* 4:23–42.

Toelken, H.R. (1996). A revision of the genus *Kunzea* (Myrtaceae): 1. The Western Australian section *Zeanuk*. *Journal of the Adelaide Botanic Garden* 17: 29–106.

Wilson, P.G. (1996). Myrtaceae in the Pacific, with special reference to *Metrosideros*. Pp. 233–245 *In*: *The Origin and Evolution of Pacific Island Biotas, New Guinea to Eastern Polynesia: Patterns and Processes,* A. Keast and S. E. Miller, Eds. Amsterdam: SPB Academic Publishing.

Appendix 1. Characters for natural language descriptions for *Lithomyrtus* and *Myrtella* as coded in DELTA (Dallwitz et al., 1993). Some characters invariant for this study are listed, given their likely value in later studies of Myrtaceae.

*Character List

#1. including <synonyms: genera' included
in the future description>/

#2. plants <growth form>/
1. suffrutescent/
2. shrubby/
3. tree-like shrubs/
4. small trees/

#3. plants <main> stems <habit>/
1. erect/
2. prostrate/

#4. plant height/
m tall/

#5. bark <texture>/
1. smooth/
2. stringy/

#6. bark <colour>/
1. brown/
2. grey/
3. orangish/

#7. branchlets <whether four-angled>/
1. distinctly four-angled/
2. rounded/

#8. branchlets <whether winged>/
1. with distinctly winged edges/
2. not winged/

#9. branchlets <vestiture >/
1. glabrous/
2. sparsely sericeous/
3. villous/
4. tomentose/

#10. branchlets oil glands <whether visible and prominent or not visible>/
1. visible and prominent/
2. absent/

#11. leaves <arrangement between nodes>/
1. distichous/
2. decussate/

#12. leaves <arrangement at nodes>/
1. opposite/
2. disjunct opposite/
3. whorled/
4. alternate/

#13. leaves <distribution: whether concentrated near branch tips or more or less evenly distributed>/
1. mostly concentrated near branch tips/
2. mostly evenly distributed/

#14. apex acuminate, leaves <texture: whether coriaceous or soft>/
1. coriaceous/
2. soft/

#15. stipules <type>/
1. consisting of 2–several short, thick,
deep red, often laterally
fused scale-like structures/
2. consisting of 2–several free
ferrugineous setose hairs/

#16. petioles <length>/
mm long/

#17. petioles <whether channelled>/
1. rounded/
2. channelled/

#18. petioles <glandularity>/
1. eglandular/
2. glandular/

#19. leaf blades <shape>/
1. linear/
2. narrowly elliptic/
3. elliptic/
4. lanceolate/
5. narrowly ovate/
6. ovate/
7. broadly ovate/
8. obovate/

#20. leaf blades <length>/
mm long/

#21. leaf blades <width>/
mm wide/

#22. leaf blades at base <shape>/
  1. truncate/
  2. cordate/
  3. cuneate/

#23. leaf blades at base <whether clasping stem>/
  1. free from the stem/
  2. clasping the stem/

#24. leaf blades at apex <shape>/
  1. obtuse/
  2. acute/
  3. retuse/

#25. leaf blade margins <whether folded>/
  1. revolute/
  2. flat/

#26. leaf blades adaxial surface <indumentum>/
  1. glabrous/
  2. glabrescent/
  3. sparsely sericeous/
  4. sericeous on lower portion of midvein/
  5. sparsely tomentose along lower edges/
  6. sparsely short villous/
  7. sparsely tomentose/
  8. tomentose/

#27. <leaf blades> adaxial midvein/
  1. impressed/
  2. flush/

#28. leaf blades lower surface <indumentum>/
  1. glabrous/
  2. glabrescent/
  3. somewhat sericeous/
  4. sericeous on lower portion of midvein/
  5. villous/
  6. densely villous/
  7. tomentose/
  8. densely tomentose/

#29. leaf blade oil glands of lower surface/
  1. absent/
  2. visible and about equal in size/
  3. visible and of differing sizes/

#30. leaf blade marginal veins of lower surface/
  1. prominent/
  2. absent or indistinct/

#31. inflorescence <type>/
  1. a solitary flower/
  2. other/

#32. peduncle <arrangement>/
  1. solitary in leaf axils/
  2. other/

#33. peduncle <stiffness>/
  1. rigid/
  2. flexible/

#34. peduncle (in flower) <length>/
  mm long/

#35. peduncle <pubescence in flower>/
  1. glabrous/
  2. sparsely antrorsely sericeous/
  3. sparsely villous/
  4. villous/
  5. tomentose/

#36. bracteoles subtending flowers <number>/
  1. two/
  2. other/

#37. bracteoles <appearance>/
  1. foliaceous and usually with midrib/
  2. scale-like and lacking midrib/

#38. bracteoles <length>/
  mm long/

#39. bracteoles <width>/
  mm wide/

#40. bracteoles <flexuosity>/
  1. ascending and rigid/
  2. irregularly flexuose/

#41. bracteole tips <length> (in flower)/
  1. exceeding base of sepal lobes/
  2. shorter than base of sepal lobes/

#42. bracteoles <indumentum>/
  1. glabrous/
  2. minutely and sparsely sericeous along edges/
  3. sparsely sericeous/
  4. villous/
  5. densely villous/
  6. tomentose/

#43. bracteoles <persistence>/
  1. persistent in fruit/
  2. caducous in fruit/

#44. hypanthium <shape in flower>/
  1. obconic/
  2. other/

#45. hypanthium <indumentum>/
  1. glabrous/
  2. densely sericeous/
  3. villous/
  4. densely villous/
  5. tomentose/
  6. densely tomentose/

#46. sepals <number>/
  1. five/
  2. four/

#47. sepals <fusion at base>/
  1. fused proximally/
  2. free/

#48. sepal lobes <fusion>/

1. coherent in mature bud/
2. separate in mature bud/

#49. sepal lobes apex <shape>/
1. acute/
2. acuminate/

#50. sepal lobes <length>/
mm long/

#51. sepal lobes <indumentum>/
1. glabrous/
2. sparsely sericeous/
3. sparsely villous/
4. villous/
5. sparsely short tomentose along edges/
6. sparsely tomentose/
7. tomentose/

#52. sepal lobes <duration>/
1. persistent in fruit/
2. deciduous in fruit/

#53. sepal lobes <habit in fruit>/
1. mostly reflexed towards body of fruit/
2. mostly ascending and above body of fruit/

#54. petals <number>/
1. five/
2. four/

#55. petals <color>/
1. white/
2. pink/
3. magenta/

#56. petals <shape>/
1. elliptic/
2. ovate/
3. broadly ovate/
4. obovate/

#57. petals <length>/
mm long/

#58. petals – adaxial surface <indumentum>/
1. glabrous/
2. glabrescent/
3. sparsely sericeous/
4. villous/

#59. petals – abaxial surface <indumentum>/
1. glabrous/
2. sericeous/
3. sparsely villous/
4. villous/
5. tomentose/
6. minutely tomentose on edges/

#60. stamens <number>/
1. numerous/
2. five/

#61. stamens <number of whorls>/
1. uniseriate/
2. multiseriate/

#62. stamens <length relative to petals>/
1. included/
2. exserted/

#63. stamens <position in bud>/
1. folded centripetally in bud/
2. other/

#64. stamens <length>/
mm long/

#65. staminal disk <indumentum>/
1. glabrous/
2. hairy/

#66. anthers <shape>/
1. rounded/
2. sagittate/

#67. anthers <attachment to filaments>/
1. dorsifixed/
2. basifixed/

#68. anthers <length relative to filaments>/
1. less than one fourth length of filaments/
2. other/

#69. anthers <dehiscence>/
1. dehiscing via longitudinal slits/
2. other/

#70. anthers connectives <glandularity>/
1. eglandular/
2. glandular/

#71. styles <length>/
mm long/

#72. styles <habit>/
1. flexuous/
2. mostly straight/

#73. styles <indumentum>/
1. glabrous/
2. sparsely sericeous/

#74. stigma apex <type>/
1. terete/
2. capitate/

#75. fruit <dehiscence>/
1. indehiscent/
2. dehiscent/

#76. fruit <type>/
1. a hard berry with bony, more or less fused seeds/
2. a soft berry/

#77. fruit <shape>/

1. subglobose/
2. globose/
3. subcylindrical/
4. cylindrical/
5. fusiform/

#78. fruit base <shape>/
1. rounded/
2. tapered/

#79. fruit <length>/
mm long/

#80. fruit <width>/
mm wide/

#81. fruit <pubescence>/
1. glabrous/
2. glabrescent/
3. sparsely sericeous/
4. sparsely villous/
5. villous/
6. sparsely tomentose/
7. tomentose/
8. densely tomentose/

#82. fruit <color>/
1. dark bluish-black/
2. yellow-green or olive-green/
3. whitish by virtue of dense hairs/
4. red/
5. brown/

#83. peduncle <length>/
mm long in fruit/

#84. ovaries <number in fruit>/
in fruit/

#85. placentation/
1. parietal/
2. axile/

#86. locules/
per ovary/

#87. seed coat <texture>/
1. hard, bony/
2. soft, somewhat pulpy/

#88. adjacent seeds <relative fusion>/
1. slightly fused, the boundaries in longitudinal section generally distinct and perpendicular to long axis/
2. tightly fused, the boundaries in longitudinal section generally indistinct and often somewhat oblique to long axis/

#89. embryo <shape>/
1. falcate to crescent/
2. circinate/

#90. embryos <oiliness>/
1. oily/
2. starchy/

#91. hypocotyl <length>/
1. relatively short/
2. relatively long/

#92. hypocotyl <thickness>/
1. relatively thick/
2. relatively thin/

#93. hypocotyl <swelling>/
1. swollen near tip/
2. not or slightly swollen near tip/

#94. hypocotyl tip <position relative to plane of embryo>/
1. somewhat spirally contorted above or below plane of embryo/
2. held at same horizontal plane as embryo/

#95. cotyledons <curvature>/
1. circinate/
2. mostly straight/

#96. cotyledons <length>/
1. relatively short/
2. relatively long/

#97. cotyledons <length relative to hypocotyl>/
1. shorter than hypocotyl/
2. about equalling hypocotyl/

#98. cotyledons <thickness>/
1. relatively thick/
2. relatively thin/

#99. cotyledons <position>/
1. not folded back towards hypocotyl/
2. folded back towards hypocotyl/

#100. <geographical range>/
1. Queensland/
2. Northern Territory/
3. Western Australia/
4. Papua New Guinea/
5. Irian Jaya/
6. Guam/

#101. <geographical range in Queensland>/
1. Cook/
2. Burke/
3. North Kennedy/
4. South Kennedy/
5. Mitchell/
6. Gregory North/
7. Port Curtis/

#102. habitat/

#103. elevation/

#104. <taxon name>/

Appendix 2. Enumeration and discussion of characters used in cladistic studies. Numbers in parenthesis following character description correspond to DELTA numbering system (Appendix 1).

1. Stem habit (3): prostrate (0); erect (1). *L. repens* is prostrate and herbarium specimens indicate a prostrate habit for *L. linariifolia*.

2. Young branch cross section (7): quadrangular (0); round (1). The character is most easily observable in young twigs.

3. Young branch wings (8): present (0); absent(1). This character is also most easily observable in young twigs.

4. Oil glands on branchlets (10): absent (0); present (1). Since the presence of oil glands on branchlets does not correlate invariably with the presence of oil glands abaxially on leaves, their expression must have a different genetic basis.

5. Leaf distribution (13): concentrated near branch tips (0); more or less evenly distributed (1). This character is not always easily determined on herbarium specimens. It is pronounced for *L. densifolia*, which has very dense foliage.

6. Leaf texture (14): coriaceous (0); soft (1). This character partially reflects patterns of pubescence on the leaves, and may need modification.

7. Mature leaf bases (23): free from the stem (0); clasping the stem (1). Stem-clasping leaves occur in *L. kakaduensis* and are occasionally present in *L. repens*. Youngest leaves of *L. grandifolia* can be stem-clasping.

8. Stipules (15): short squamose structures that are often fused laterally (0); free short setose hairs (1). The differences in character states are readily apparent on herbarium specimens. The stipules of *Lithomyrtus* resemble those in Fig. 3b of Dahlgren & Thorne (1985); those of *Myrtella* somewhat resemble the stipules in Fig. 3f (op. cit.), but are shorter, broader and fused at the base.

9. Petiolar oil glands (18): absent (0); present (1). Since petiolar oil gland presence is not correlated with glands elsewhere, it is assumed to have a distinct genetic basis.

10. Leaf blade base shape (21): truncate (0); cordate (1); cuneate (2).

11. Abaxial leaf oil glands (29): indistinct (0); visible (1).

12. Marginal adaxial leaf veins (30): absent or indistinct (0); prominent (1)

13. Bracteole type (37): foliaceous with a distinct midrib (0); scale-like and lacking a midrib (1).

14. Bracteole flexuosity (40): ascending and straight (0); flexuose (1).

15. Bracteole length (41): longer than base of sepal lobes (0); shorter than base of sepal lobes (1).

16. Sepal lobe arrangement in bud (48): coherent in mature bud (0); separate in mature bud (1)

17. Sepal lobe apex (49): acute (0); acuminate (1).

18. Sepal lobe position in fruit (53): mostly reflexed against body of fruit (0); mostly above body of fruit (1).

19. Staminal disk vestiture (65): glabrous (0); hairy (1). The staminal disk is the apex of the hypanthium on which stamens are inserted.

20. Anther connectives (70): eglandular (0); glandular (1). *Lithomyrtus retusa* usually has two or more oil glands per anther, which can arise from the connective or anther wall. No quantification of glands was attempted (e.g., Landrum & Bonilla 1996).

21. Fruit base shape (78): rounded (0); tapered (1).

22. Relative fusion of seeds (88): slightly fused, the boundaries in longitudinal section distinct and perpendicular to long axis of fruit (0); tightly fused, the boundaries in l.s. indistinct and often oblique to long axis of fruit (1).

23. Embryo shape (89): slightly curved (0); circinate (1).

24. Hypocotyl length (91): relatively short (0); relatively long (1). The alternative states are very apparent between *Lithomyrtus* and *Myrtella*, although they may be of limited use in Myrtaceae as a whole (see Landrum & Stevenson 1986).

25. Cotyledon length (96): relatively short (0); relatively long (1). The comments for character 24 apply equally here.

26. Cotyledon thickness (92): relatively thick (0); relatively thin (1). The comments for character 24 apply equally here.

27. Hypocotyl tip (94): somewhat spirally contorted above or below plane of embryo (0); held in same plane as embryo (1).

Table 1. Character coding for cladistic analysis (cf Appendices 1 & 2); all characters unweighted and unordered. Taxon numbers follow sequence in manuscript.

	Taxon												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Character													
1	1	1	1	1	1	1	1	1	0	1	1	0	1
2	0	0	1	1	1	1	1	1	1	1	1	1	1
3	0	0	1	1	1	1	1	1	1	1	1	1	1
4	0	1	0, 1	1	1	1	1	1	1	1	1	1	0
5	1	0,1	0	1	1	1	0,1	0,1	1	1	0,1	1	0,1
6	1	0,1	0	1	1	1	0,1	0,1	1	1	0,1	1	0,1
7	0	0	0	0	0	0	0	1	0	0	0	0, 1	0
8	0	0	1	1	1	1	1	1	1	1	1	1	1
9	0	0	0,1	0	0	0	1	0	0	0	0	0	1
10	0	0	0,1	2	2	2	0,2	1	2	0,2	2	0,1	2
11	1	1	1	1	0	0	0	0	0, 1	0	0,1	0 1	1
12	1	1	0,1	1	1	0	1	0	1	1	1	0,1	1
13	0	0	1	1	1	1	1	1	1	1	1	1	1
14	1	1	0	0	0	0	0	0	0	0	1	0	0
15	0	0	0,1	1	0,1	1	1	1	1	1	0	1	1
16	0	0	1	1	1	1	1	1	1	1	1	1	1
17	1	1	0,1	1	0,1	1	0,1	1	0,1	0,1	1	0	0
18	1	1	0	1	1	0	1	1	1	0	0	1	1
19	0	0,1	0,1,2	1,2	0,1,2	1	1	1	1	0,1,2	1	1,2	1
20	0	0	1	1	1	1	1	1	1	1	1	1	1
21	0	1	1	1	1	0	1	1	1	0, 1	1	0	1
22	1	1	0	0,1	1	0	0	0	1	1	1	1	0
23	0	0	1	1	1	1	1	1	1	1	1	1	1
24	0	0	1	1	1	1	?	1	?	1	1	1	1
25	0	0	1	1	1	1	?	1	?	1	1	1	1
26	0	0	1	1	1	1	?	1	?	1	1	1	1
27	0	0	1	1	1	1	?	1	?	1	1	1	1